





ANIMAL KINGDOM

NEW YORK ZOOLOGICAL SOCIETY



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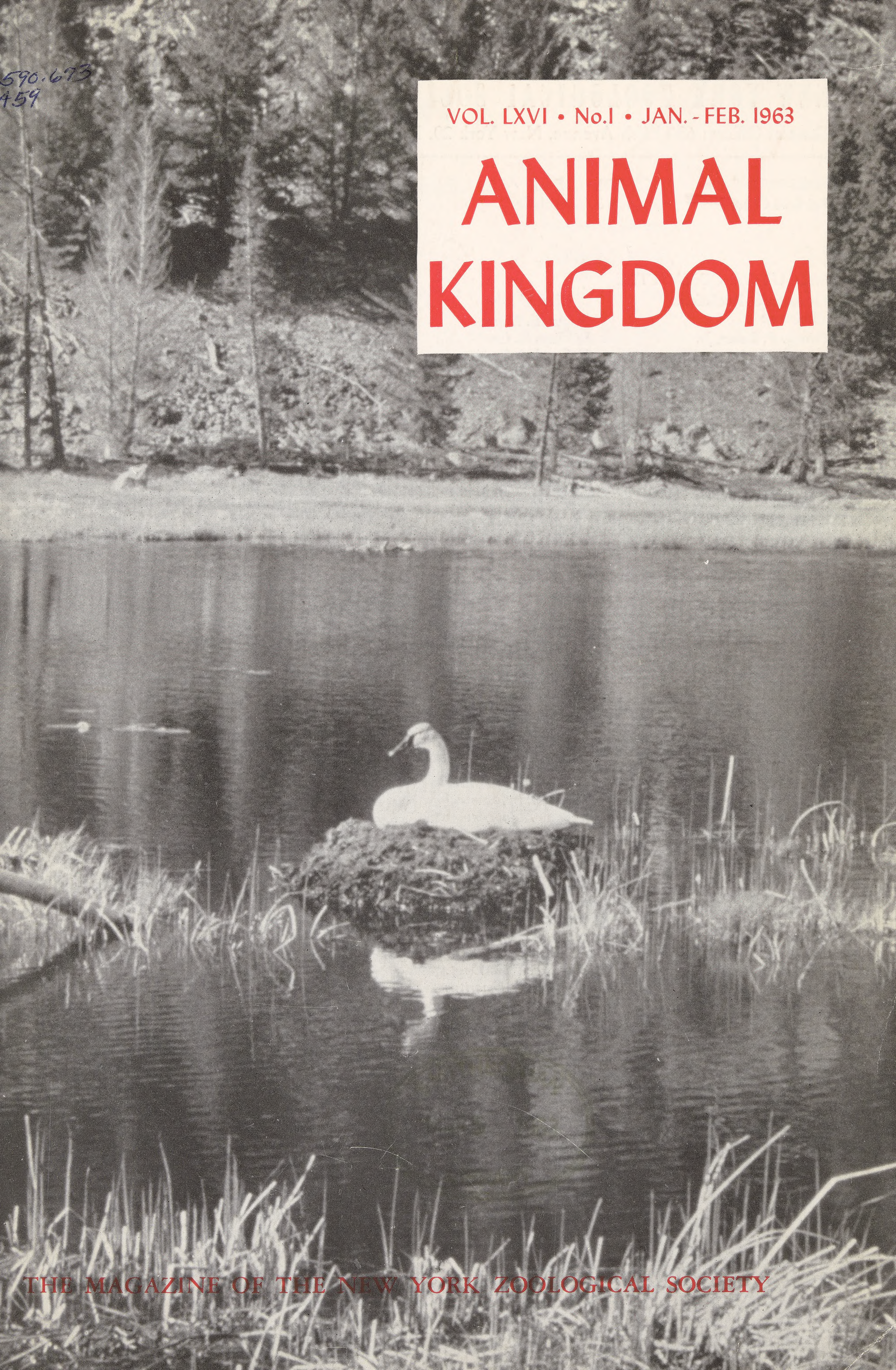
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ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

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in Yellowstone National
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(Photo by Robert Reville)

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The Sixty-seventh Meeting at the Waldorf-Astoria

Our Society—At Home and Around the World

THIS YEAR'S Meeting of Members was an extraordinarily en-
couraging occasion. The sheer number of those who attended,
some 2,000 or more, provided fresh evidence of the love that
people have for animal life—as well, we may hope, of our
Members' belief in what the Society is doing.

Among the exhibits in the entrance hall was a map of the
world illustrating the far-flung work of the Society in zoological
research and wildlife protection. In the preceding issue of this
magazine, a special report was presented that highlighted some
of the major activities of the Society in these fields of its interest.
In this issue there is a reproduction of the map referred to
above. It pinpoints the work of the Society in other parts of
the world. While it is true, of course, that our major responsi-
bilities from a public point of view are the constant improvement
and development of the Zoological Park and the Aquarium here
in New York, the fact still remains that our work knows no
borders. The need for wildlife protection will continue un-
diminished through the long years ahead and the search for
zoological knowledge is one that has no ending.

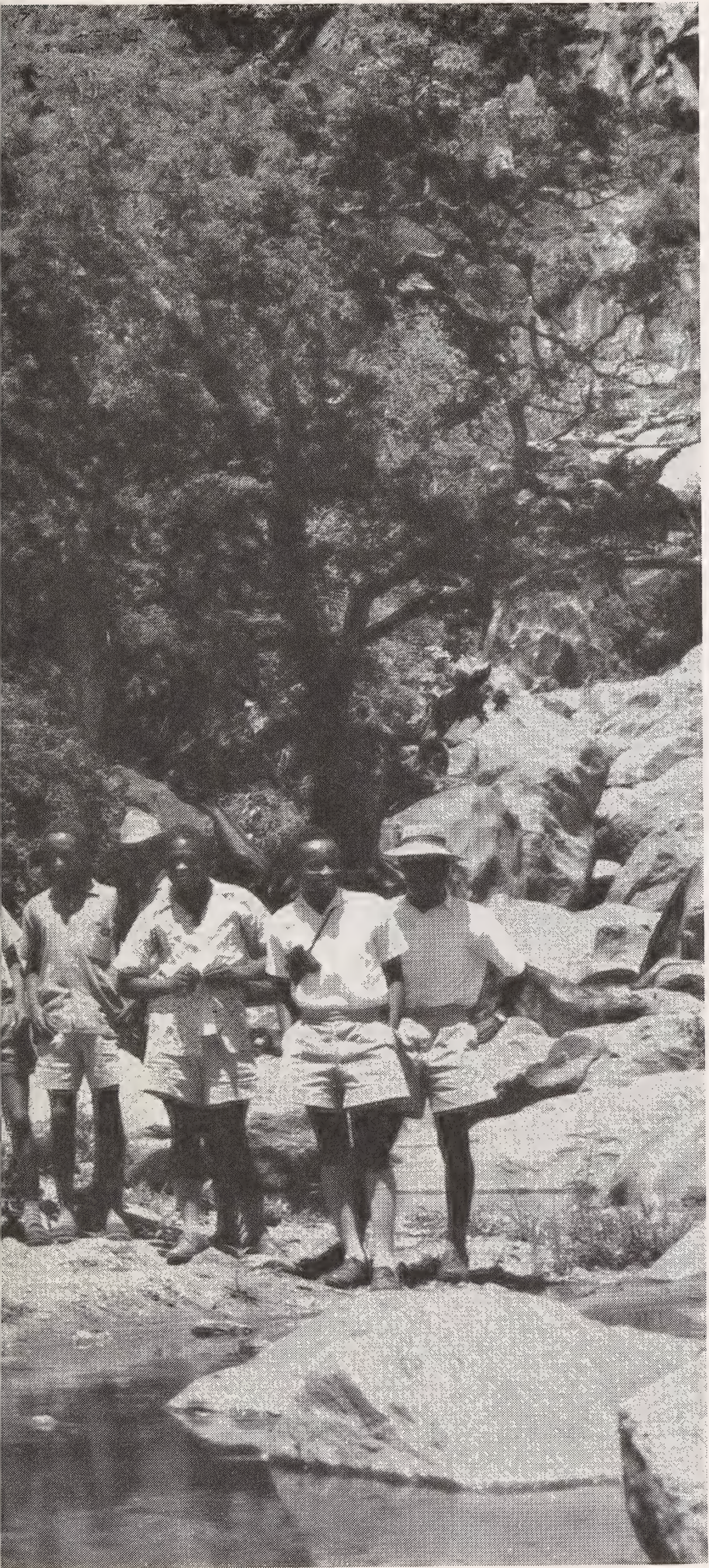
Fairfield Osborn

THEY "READ THE BOOK"



F NATURE"

By WILLIAM EDDY



"nature walk," Tanganyika-style. These youngsters are members of one of the school classes described by the author. After a picnic lunch, they are getting a nature talk by the new African teacher.

Photo by the author.

THIS REPORT ILLUSTRATES one of the ways through which the New York Zoological Society is helping to save the wild animals of Africa. It is evident that unless the African people themselves, now that so many are self-governing, become conscious of the values of wildlife, one of the greatest natural heritages of the world may be lost.

The author came in to see us about two years ago. He had had ten years of successful experience in teaching in schools in this country. He told us he had become so concerned about the crisis of the animals of Africa that he was determined to help in some way to resolve it and was prepared to take a leave of absence from his career to accomplish this.

Specific plans were prepared as to where to initiate work and what kind of educational programs should be undertaken. The Ford Foundation responded with a grant to carry costs over a two-year period. Our Society welcomed the opportunity of sponsoring the program and, through our African Wildlife Fund, provided additional funds for the production of educational films, now used in school systems in Tanganyika.

While Mr. Eddy has been in East Africa for only a relatively short time, he has already made great progress in developing educational programs of this kind in Tanganyika. We are now going to do all that we can to get them adopted in other African countries.

FAIRFIELD OSBORN

ALOT HAS BEEN GOING ON. The Manyara dormitory has had four groups of student visitors, 22 in each. They've varied in age from 8th Grade to 12th Grade, but their response has been unanimously enthusiastic. The new African school teacher, hired as assistant Park Warden at Manyara to help with the education program, is becoming more and more excited by his job. He has much to learn himself, but he is a willing guy and he feels he's doing something that has a real future. At first he was terrified of animals. He thought lions would eat him at

night or that rhino would attack him on sight. He is typical of most local Tanganyikans. He had never seen elephant, buffalo, lion, rhino, hippo, leopard or impala. Now that he's been at the job for about 6 weeks he's becoming very enthusiastic about the work.

Because Manyara is only 80 miles from Arusha it seemed best to use this as an experimental area for the education program. The ideas that come out of this work can then be adapted for use in the other Parks. My aim has been to develop a method of approaching the kids which can be "packaged" fairly simply and communicated to Africans in charge of the education program in the other Parks. Very briefly, what we've tried to do is this:

The kids arrive about 4:30 in the afternoon. A schedule has been made for their visit that keeps them fairly busy. After being welcomed to the dormitory and told that it is their building, they are given a cup of tea and the daily schedule is communicated to them. Then they walk a mile or so to the museum gate house of the Park. In the center of that room is a covered exhibit. They are allowed to look around a bit at various things — the butterfly collection, the birds' eggs, bottled snakes and so forth. By and large they learn little or nothing in doing this because the exhibits are fairly static. After about ten minutes of look-

ing their interest lags. The next step is uncovering the table in the center. The table is set up something like this:

Each of the four divisions contains various objects. #1 has a hedgehog in leaves and grass; a pair of stone-colored eggs among sand and pebbles; a mottled moth on a piece of bark. Obviously the concern here is with camouflage. #2 has two butterflies with bright orange wingtips, on a piece of bark. A third butterfly with eye spots on the wings accompanies another piece of bark. The aim here is to show another use of color — to divert attack. #3 has two butterflies — both brightly colored. The purpose here is to show bright color as a warning and to show the use of mimicry. #4 is empty.

The whole process of introducing the subject to the kids is done by questions. They are told no facts but one — that the bright butterfly in #3 is poisonous. After they have looked at this exhibit a minute or so, they find it is essentially meaningless. Then they are asked:

"How many of you can read Swahili?"

All the hands naturally go up. A student is picked to read from a Swahili book. After a couple of sentences you stop him and ask:

"Why can you read Swahili?"

"I've been taught in school," he says.

Then you ask, "Do you know anyone who can't

4. EMPTY	1. MOTH ON BARK  EGGS AMONG STONES  HEDGEHOG IN LEAVES & GRASS 
3. BRIGHT-COLORED POISONOUS BUTTERFLY  BRIGHT-COLORED MIMIC 	2. TWO BUTTERFLIES ON BARK - ORANGE WINGTIPS   BUTTERFLY WITH EYESPOTS ON WINGS 



Left — The object-lesson table in the Museum.
Above — There's no doubt about the thrill this Il Boru boy is getting out of seeing a live Lion; indeed, it may well be the first living Lion he has seen.

Photo by the author.

read Swahili — anyone who, if he looked at this page with its print, would think it all meaningless?"

"Oh, yes," is the response.

Next question. "Who is the richer person, the person who can read Swahili or the person who cannot?"

Obviously the question is loaded, but you get the answer you want. Then, with the book in hand, you go over to the table.

"This is a book, too," you say, "but a different book from the book of Swahili — this is the book of nature. On the table are shown just a few of the many words in this book and you are going

to learn how to read them if you can."

Then the process begins of asking them to look at #1 to see what the objects have in common. Once they get the idea they move like lightning.

"If an egg is hard to see because it looks like the background in which it sits, then what use is this to the egg or to the bird," you ask.

It's remarkable how interested they get. You move to #2 in the same way.

"You are a bird, and very hungry. You are flying through the forest and you see these two bright spots on this butterfly's wingtips. What if you strike one of them? What happens to the butterfly? Where would you strike a butterfly if you were a bird?"

"On the head," they say.

"All right." Then you ask, "What part of that butterfly is furthest from his head?"

"The tips of the wings," they answer.

"Where are the bright spots located?"

The response is a long "Oh!" They begin to think butterflies are pretty clever.

Then you go on to #3 — to warning colors and to mimicry. Again, the only fact you give them is that one of those butterflies is poisonous.

Finally you come to #4, the blank space. Here you begin a story about two African boys — the classical Swahili pair of Juma and Ali. Juma is somewhat of a clod who feels manly when he steps on wounded birds; Ali is the guy who's bright in school, who asks questions, and who is "liked by all." Instead of killing the injured bird he picks it up — at which point, like the magician, you reach inside a covered box and come up with an injured bird. In this case it was a European Nightjar. Then the story goes on about what Ali learned by asking a Park Warden about this bird — the migration southwards across the Sahara to Tanganyika when Europe is covered with ice and snow; the hunting for insects; the short useless legs because he sits on the ground instead of perching; the wonderful camouflage; the big eye and special beak. Ali learns about all of these things. Juma had stepped on a similar bird on his way home from school. Now who is the richer boy, Juma or Ali? Another loaded question.

All of this ends with another gimmick. You ask the kid who first read the Swahili to read in another book. He picks it up, looks at it and stops.

"This is not Swahili," he says. It turns out to be French or German.

Then you ask why he can't read it.

"I've not been taught."

"When you came into this room, none of you could read in the book of nature either. Now you have learned a few words. There are many more. Do you know any people who might come into this room and look at this table with its four compartments and see nothing? Why would they see nothing? Because they had not been taught to look. Okay, who is richer, the man who can read the book of nature or the man who cannot?"

The last loaded question is asked and the "lesson" is over.

It all takes about an hour and then back to the dormitory they go. Obviously you cannot always have an injured bird on hand for the last effect, but the point is that section #4 on the table can

be used to move away from the limits of a museum to bring in some more human or "live" aspects of what you are trying to get across to them.

The teachers have been very excited about the lesson. They want to be able to teach these things in the schools. One teacher came out of the museum and made the comment, "This is the first time I realized how much I do not know." I doubt if he really understood the profundity of his own statement.

By the time the museum visit is over, supper is ready. Then afterwards there is a short evening program. The kids are now told things and have a chance to ask questions. They learn about what a Park Warden has to do — the variety and complexity of his job from building dormitories to knowing how many lions there are in the Park. Then the head Game Scout, an African, tells them about his job. The kids love this because they see it as a job fraught with danger — stalking by the elephants, counting rhino and determining their sex. What impresses the students is that although the scouts carry guns they have never had to use them for protection. The Game Scout tells them that a dead elephant is worth far less than a live one. He says that tourists will not come to Africa to see dead animals.

After getting some information about the jobs of the people who work for the Parks, they ask questions. There are some tough ones — such as "Why is a man who goes into the Park and shoots an impala punished and a lion who kills an impala is not?"

Finally a film is shown. Usually we show the Manyara film and the response is wonderful. The kids realize that the next day they may be having the same experience themselves, so the movie seems "real" to them.

The next day they leave for the Park at 8:00. They spend the whole day there and have a picnic, coming out about 4:00. After a final cup of tea, the guest book is signed, and they leave for their school. Every group so far has seen all the major animals except leopard and hippo. It's common for them in one day to see perhaps 150 elephant, a herd of 300-500 buffalo, lion, wildebeest, zebra, giraffe, impala and rhino.

The problem now is to adapt the concepts used at Manyara for the Serengeti and Ngurdoto Crater. I hope I can do this before March.

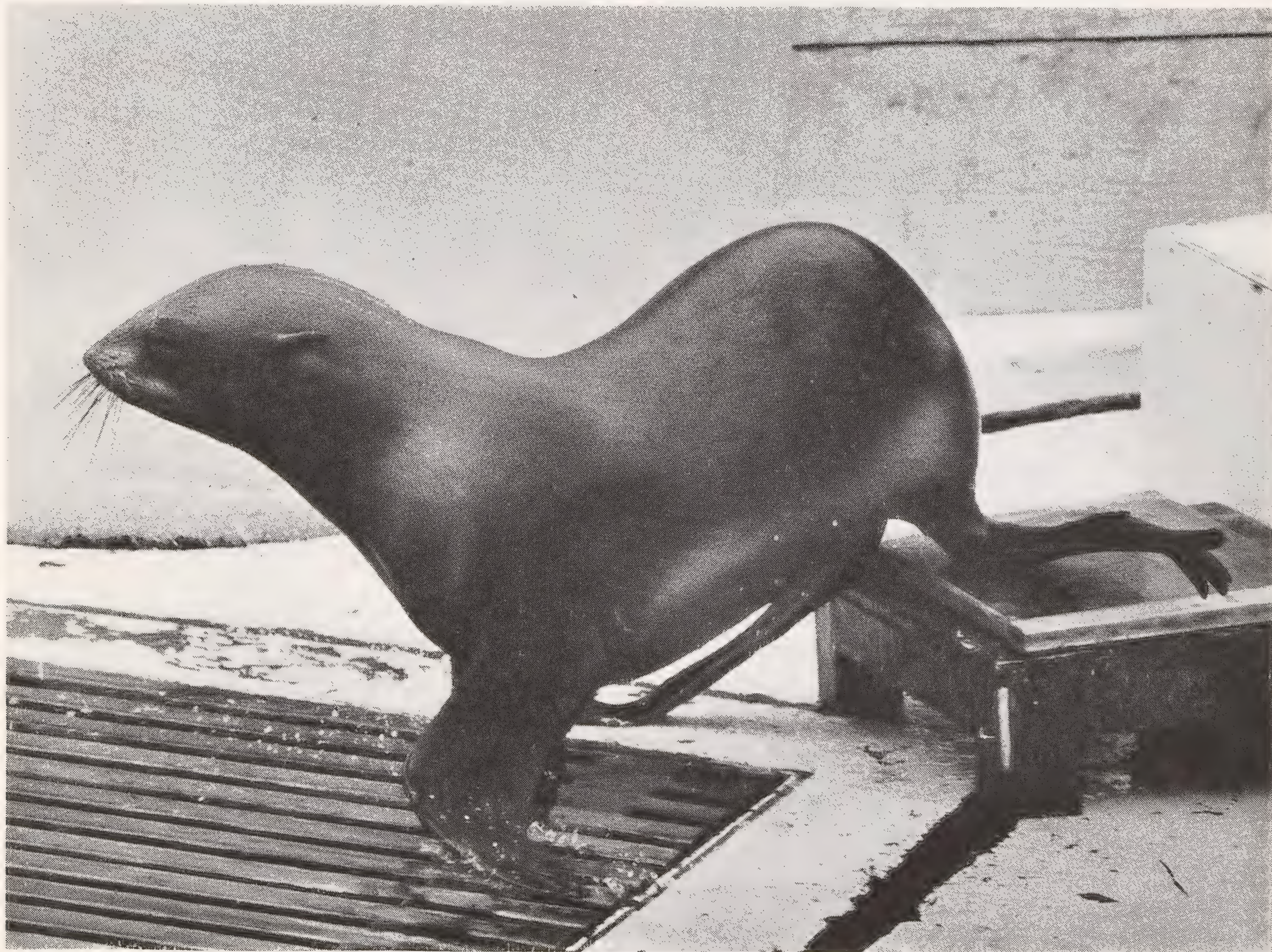
Introducing “Gina” the Aquarium’s Baby Fur Seal

By JAMES W. ATZ

Curator, New York Aquarium

Photograph by Emmy Haas

THE WORLD of a zoo or aquarium man is full of surprises; no two days are ever the same and eventually one almost comes to expect the unexpected. During 1962 the Aquarium received its share of surprises, but everyone without question agrees that the most enjoyable was Gina, our young Northern Fur Seal. Gina was entirely unexpected and unplanned for. On October 29 we suddenly received a message asking us whether we would take care of a fur seal that had been unclaimed at Idlewild International Airport for four days. We hastened to the airport expecting to find a bedraggled, perhaps even half dead creature, but instead discovered an alert and active one, although understandably somewhat ruffled in appearance and disposition. In less than a minute after she was released from the confines of her shipping box into a quarantine enclosure at the Aquarium, the little seal was swimming





vigorously about and within twenty minutes she had eaten three pounds of herring.

If Gina's adaptation to life at the Aquarium was remarkably rapid, *our* response to her was no less so. One good look at her petite, lithe form and a few seconds' exposure to her frisky, fearless manner were all that was necessary to win us over completely. Even the incongruity of her voice — more of a croak than a bark — added to her charm. Our visitors, too, have found her charming; there is always a circle of happy, animated faces watching her disport in a section of the Tripool.

Gina shares her pool with Flip, the Aquarium's Ringed Seal. Together they make an instructive exhibit that vividly shows the distinction between seals and sealions, which people so often find confusing. The two animals are about the same size and as they swim together, practically under the noses of visitors, it is easy to distinguish between the two related but distinctive types. The fur seals and sealions, which comprise the Family Otariidae, are also called the eared seals, while the earless seals, of which Flip is a representative, belong to the Family Phocidae. The latter are sometimes called the hair seals to distinguish them from the fur seals, but the fact that the vernacular names "seal" and "sealion" do not

correspond to the two zoological groups has been a source of much confusion. There is some truth in the assertion that the Fur Seal is really a sealion; the similarity of Gina to a California Sealion, the familiar, so-called trained seal of circus and vaudeville, is immediately apparent. Mammalogists recognize four or five species of sealions and seven different fur seals, all of which possess external ears, hence the group name, eared seals. These structures, however, are no bigger than a lead pencil and seldom if ever exceed two inches in length, so that their possession is noteworthy only in comparison to the other seals which lack external ears entirely, the only sign of their organs of hearing being a pair of small holes located some distance behind the eyes.

The outstanding differences between the fur seals and sealions on the one hand and the earless seals on the other concern their methods of locomotion, both on land and in the water. Fur seals and sealions swim by means of their large front flippers, their hind flippers being used as rudders. In the earless seals, the hind flippers are the principal organs of propulsion in water, while the front ones are used mostly for turning and other maneuvers. Gina and Flip demonstrate the contrasting methods very well. Gina darts about



The Fur Seal (Callorhinus ursinus) spends a considerable amount of time grooming its thick oily fur. With its large front flippers it rubs its head and body thoroughly. Occasionally, however, it uses one hind flipper, as seen on the left. How well the skin of the flippers repels water is shown on the right.

the pool with powerful and simultaneous but intermittent strokes of her front flippers, while Flip cruises along, propelled by a gentler, side-to-side motion of his hind flippers, which are held more or less in the vertical plane as they are moved back and forth continuously and together. Both animals are capable of bursts of speed, but Gina appears to have the more efficient locomotor mechanism, for she can literally swim circles around her companion.

The superiority of the eared seals is even more apparent on land. They can walk or run by virtue of their ability to support the body on the two pairs of limbs. In order to do this, each hind flipper must be turned forward to a certain extent and the back arched to bring the flippers underneath the rear part of the body. Offhand, such an arrangement might not seem effective, but most of us can remember how agilely trained "seals" get around during an act. On land Gina



behaves almost exactly like a California Sealion, but Flip, like all earless seals, must depend on laborious-looking wriggling motions in order to move around out of water. Since the hind flippers cannot be rotated forward, they are of no help at all, and the front ones are not large enough to do more than make rowing, scrabbling motions.

In nature, Northern Fur Seals make good use of their terrestrial agility, since the islands on which they breed are rough and rocky. For six or seven months of the year, however, they are strictly aquatic, remaining at sea and never touching land. We see this reflected in Gina's behavior; she hardly ever leaves the water. Although





“Gina” sometimes strikes this prayerful attitude while grooming her face. This is one of the unusual positions she takes that delight our visitors.

“Gina” rarely leaves the pool except to be fed. Tankman Arthur Heine has trained her to climb into his lap to eat, but she still wants no petting.

she would certainly prefer to eat her meals in her pool, Tankman Arthur Heine, with patient coaxing, has trained her not only to leave the water but to climb into his lap to be fed. During daylight hours Gina spends almost the entire time swimming, an activity that for her appears to be as effortless as breathing. At night she sleeps only part of the time, lying on her back at the surface with her large flippers close to her body.

Such vigorous activity must require a great deal of energy, and Gina gets hers from the large

quantity of fish that she consumes — about eleven lbs. each day. Gina is also growing. When we received her, she weighed 26½ lbs. and nine days later, on November 7, she weighed 35½. Most of this spectacular gain, however, undoubtedly represented a recovery of weight lost during the several days she went without food before we rescued her. Since then, her weight has increased at what seems to be a more normal rate, and on January 7, she weighed 38 lbs.

Keeping warm is another energy-consuming activity of fur seals. For a warm-blooded animal, life in the chilling waters of the ocean presents a most serious problem. In fact, Dr. Victor B. Scheffer, who is one of the foremost authorities on seals and their relatives, believes that the difficulty in maintaining a high, constant body temperature while living in water may very well be *the* barrier that has kept all mammals — except the whales, porpoises and dolphins, the seals, sealions and walruses, the manatees and the sea otter — out of the sea. These marine mammals

have acquired a thick coat of blubber to insulate their bodies from the sea's life-sapping cold — with the exception of the sea otter, which depends on a special kind of fur to keep it dry and warm, and the fur seals, which have both blubber and fur. It is their fur, of course, that provides the fur seals' chief claim to fame and also brought them nearly to the brink of extinction.

Anyone who ever looks at and touches an Alaska fur seal coat cannot readily forget what a luxurious experience its incredible softness and rippling beauty provide. When people see their first fur seal coat "on the hoof" as you might say — which most visitors to the Aquarium are doing when they make Gina's acquaintance — they are disappointed because the coat of a live fur seal does not at all resemble the fur seal coat of commerce. In fact, it looks the same as the covering of any ordinary sealion. What our visitors see is an outer layer of long, coarse guard hairs, as they are called. Underneath lies a second layer of short, fine underfur. There are more than 300,000 hairs per square inch, about 98% of them being of the underfur type. When a fur seal skin is prepared for the furrier, it is heat-treated, and this loosens the guard hairs so they may be plucked out, leaving the soft underfur in place.

This double layer of hair keeps the skin of the fur seal warm and dry no matter how cold the water may be. The guard hairs are flattened and oily and they are inserted into the skin on a slant so that they cover the underfur like shingles on a roof and also help streamline the animal. The underfur is also oily and unwettable and it forms a dense, curly mat. Even when Gina grooms herself, rubbing her fur the wrong way so that the underfur is exposed to the water, her skin does not get wet. Next to swimming, grooming is the activity that Gina indulges in most frequently. She does this only in the water. Usually she lies on her back and rubs her body, head and face with her front flippers, but occasionally one hind flipper is brought into play. The way she turns and twists and the obvious satisfaction she obtains make the performance particularly enjoyable to visitors.

Gina was born last June in the Pribilofs. We can be reasonably certain of this, even though we do not have any specific details of her history, because of the wealth of information that has

been accumulated on the natural history and biometrics of this commercially valuable species. More is undoubtedly known about the life history of the Northern Fur Seal than any other sealion, seal or walrus. The gross value of the harvest of pelts is in the order of \$5,000,000 a year, for which 30,000 to 100,000 adolescent males are killed annually under government supervision.

The Pribilof herd of Northern Fur Seals now consists of about a million and a half animals, but in 1909 it had been reduced to 134,000, mostly because of uncontrolled hunting on the high seas. In 1911, Great Britain, Japan, Russia and the United States signed a convention that prohibited pelagic sealing and provided for each country to share in the money realized from the sale of sealskins. Although the U.S.A. owned the Pribilofs, where the actual harvest was taken, the seals did much of their feeding and growing in Canadian, Japanese and Russian waters, as well as those off Alaska and our Pacific coast. This agreement proved to be milestone in the rational exploitation of marine resources.

The Northern Fur Seal is a good exhibit on several counts. It is of particular interest as the source of expensive fur coats — and as an example of how scientific knowledge and enlightened self-interest can be combined to bring about the conservation of a species. It is a rarity, partly because it has not, in the past, thrived in captivity and partly because special Federal permits are necessary to keep it. But most of all, Gina has shown us that the Northern Fur Seal is an adaptable creature whose tireless, graceful activity never fails to fascinate the public. Now we have begun to dream of a special Fur Seal Exhibit. It would be designed to keep secure such high-jumpers and would have a rocky haul-out on which the animals could exhibit their agility on land. There appears to be no reason why we could not exhibit one of the great 400- to 600-lb. males with a small harem of the 100-lb. females. We have salt water of the proper temperature — something no zoo that has ever tried to keep Northern Fur Seals has ever had. Then, in the late spring, we might give our visitors a stay-at-home view of a bit of the great drama that is enacted each year in the forbidding Pribilofs, when hundreds of thousands of Northern Fur Seals come ashore to carry on their race.



Not a "Butcher Bird"—

THE HELMET SHRIKE

By PETER L. AMES

Assistant Curator of Birds

ANYONE WHO KNOWS even a little about North American birds is likely to have heard of the Shrike, perhaps under its alternative common name of "Butcher Bird." It has (to the more squeamish of us) the unpleasant habit of killing other small birds and insects and

impaling their bodies on thorns. We all know that birds have to eat, that many birds kill to eat—but to hang up their prey in full sight . . . Butcher Bird, indeed!

It is gratifying, then, to report that the Zoological Park has just acquired another kind of

shrike and one that from a human point of view is almost wholly admirable. This is the Straight-crested Helmet Shrike of Africa, scientifically known as *Prionops plumata poliocephala*. It has an alternative common name, too; among some African tribes it is called the "Leopard Bird," although not because it acts like a Leopard. On the contrary; flocks of helmet shrikes have been known to mob the predatory big cats.

There are nine species of helmet shrikes and they range all through the forested areas of equatorial Africa. They are hardly distinguished in form or color; for the most part they are small — seven to ten inches long — and predominantly black, gray and white. Most do have their touches of color, with bright red-orange legs and a matching fleshy wattle around the eye. The feathers of the forehead are extended forward and upward in a prominent crest — the helmet — and this combines with the wattle to give the bird a rather quizzical expression.

Its relationship to the typical shrikes is betrayed by the beak, which is hooked on the ends.

But it is its *differences* from the typical shrikes that gives it a special interest.

Most shrikes are solitary wanderers and staunch defenders of the territory they consider their own, but helmet shrikes travel through undergrowth in amicable parties of four to a dozen as they forage for the insects and spiders that are their sole food. Indeed, it is because of their reluctance to accept any food that does not wriggle that they are seldom seen in a zoo. Many other African shrikes also subsist largely on insects but will readily accept substitutes in the zoo. It is only with the greatest difficulty that helmet shrikes can be induced to take non-insect food and their survival in the zoo seems linked with an abundant supply of mealworms — which we can supply.

Working through the underbrush, a flock of helmet shrikes is reported to keep up a more or less constant chattering and bill-snapping. Our birds are rarely heard to snap their bills, but soft chattering notes are not uncommon.

Another difference from other shrikes is the gregariousness of their nesting behavior. The nest of a pair seems to be the communal responsibility of the flock with which the pair is associated. Let a predator come along and the whole flock joins in the defense of the nest — and cer-

tainly a flock of flitting, bill-snapping, darting birds is likely to be much more distracting to a predator than a single bird or even a pair. The individuals of the group actually seem to gain confidence and boldness from the support of their fellows. F. M. Benson, one of the few close observers of helmet shrikes, tells of a three-foot snake that was so harried by a party of the birds that it withdrew eighty yards from the nest before they broke off. They will mob an intruding man as readily as a snake — and, as mentioned above, their native name of "Leopard Bird" comes from their forays against the spotted prowlers.

Their community spirit comes out in even more unusual ways. A pair will let other members of the party visit the nest, and in some species more than one female may lay in a single nest, although incubation is done only by the owners of the nest. But it is when the time comes for the exchange of incubation duty by the pair that helmet shrikes most certainly gain our admiration. A flock of six to eight birds flits through the nest tree in a chattering, ever-shifting wave. The bird on the nest slips into the noisy group while its mate quietly takes over the nest. The flock moves on to another tree, still chattering and snapping their bills, leaving any but the sharpest-eyed and most acute observer unaware even that there was a nest and that an exchange has been made.

Cooperation does not stop here; young helmet shrikes are fed by members of the entire flock — an arrangement which probably provides a most efficient utilization of the fluctuating insect population.

It is natural that birds of habits as unique as those of the helmet shrikes should enter into native myths and folklore. Natives in northern Nigeria believe that an arrow moistened with the blood of a helmet shrike in addition to the usual plant poison will kill not only the man it strikes but his entire family. Perhaps this belief is linked to the characteristic way in which a party of helmet shrikes flutters about a fallen member of the flock — a habit that unfortunately often results in other members of the group being killed.

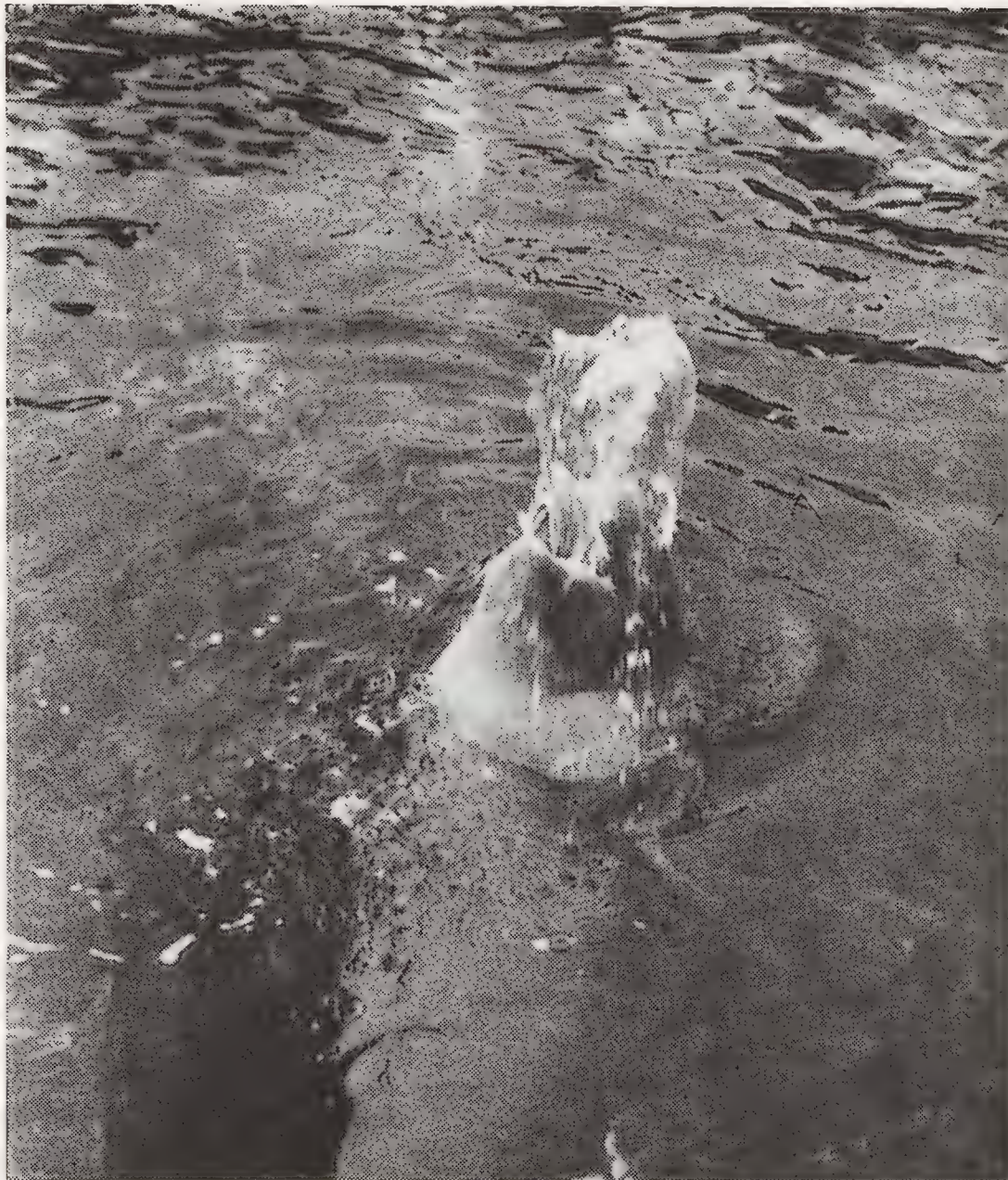
There is still a great deal to learn about these little birds of the great African forest — even their habits in captivity. We mean to keep an eye on ours.

ZOO NEWS IN PICTURES

Photographs By
SAM DUNTON

As if in imitation of those familiar fountain ornaments in which creatures of the sea spout streams of water, a couple of the Belugas at the Aquarium occasionally surface and shoot a jet into the air. They can do it with mouth open, as at the right, or with it closed, as below, simply by pressing the tongue against the roof of the mouth. We have no idea why they do it: possibly it is play.

Both photos by Emmy Haas





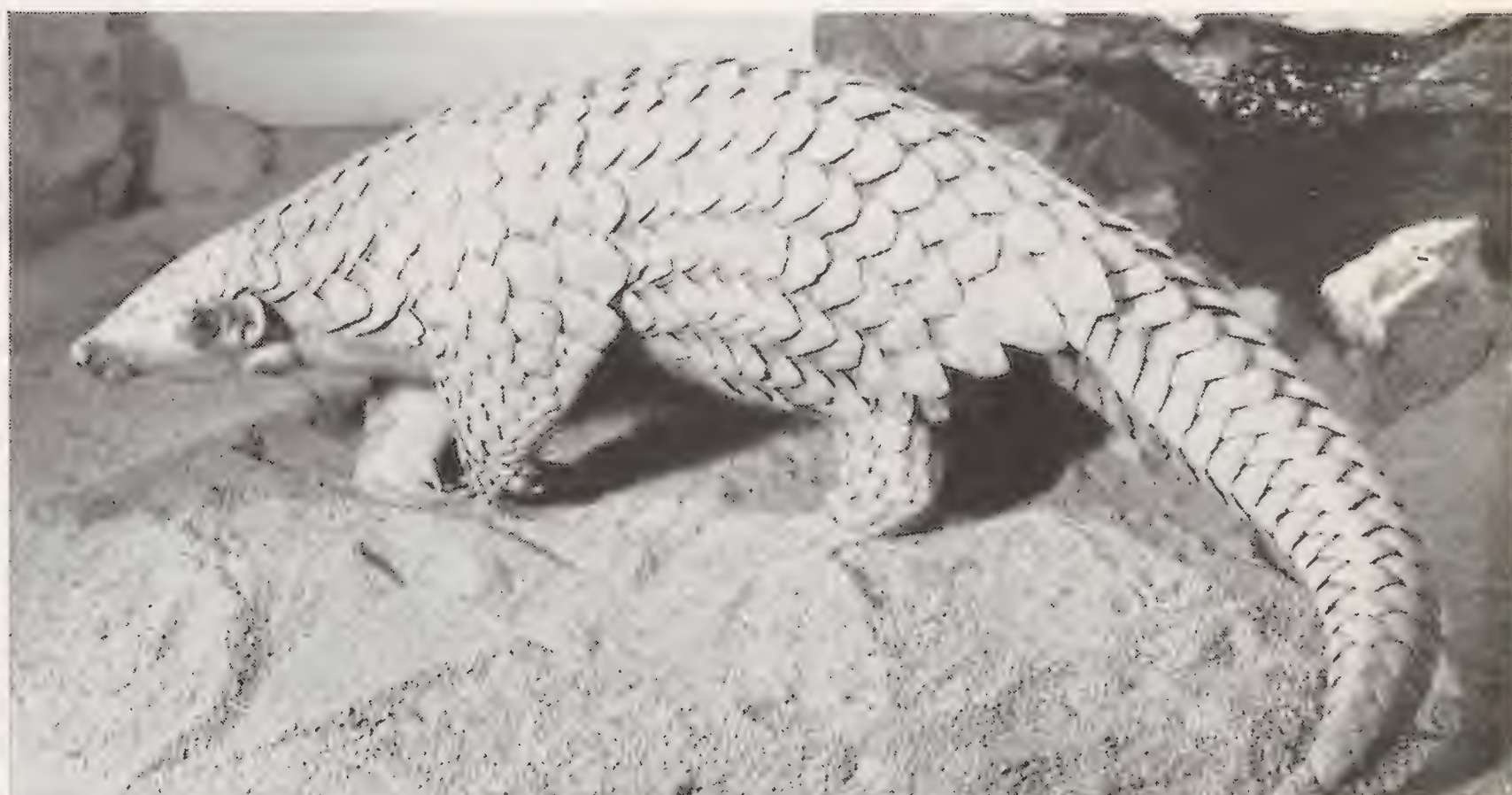
In preparation for the eventual expansion of the African Plains, we have acquired a herd of seven Blesbok — two males and five females. Shown here are four of the females in their winter quarters in the Yak House. At first they were inclined to jostle each other, and so we put bales of hay in the stall, thus breaking up the space into a number of small "rooms."

Human beings often show a pardonable curiosity about new neighbors — so why shouldn't an Asiatic Elephant and an African Black Rhinoceros take an interest in each other? These pictures were made during the fall when Little Joe, the rhino, was moved to a yard alongside the elephants. Presumably they had never seen a rhinoceros of any kind, and Little Joe was an exciting novelty. The elephants were careful, however, not to put their trunks out far enough for the rhino to stab them with his horn. Little Joe's excitement took the form of much ponderous cavorting.





Our Indian Pangolin is on its way to setting a record for longevity in the collection. It came on April 28, 1961, and is thriving on a diet of chopped meat, raw egg, milk and Pablum with a small added amount of a vitamin supplement.



This animal seems never to have been exhibited alive before — and, in fact, it is otherwise represented only by two skins in the Chicago Natural History Museum. It is the Black-shouldered Opossum, *Caluromysiops irrupta*, from Peru. The type specimen was taken in the Province of Cuzco, while ours came out of Iquitos, 700 miles to the north.

Madagascar:

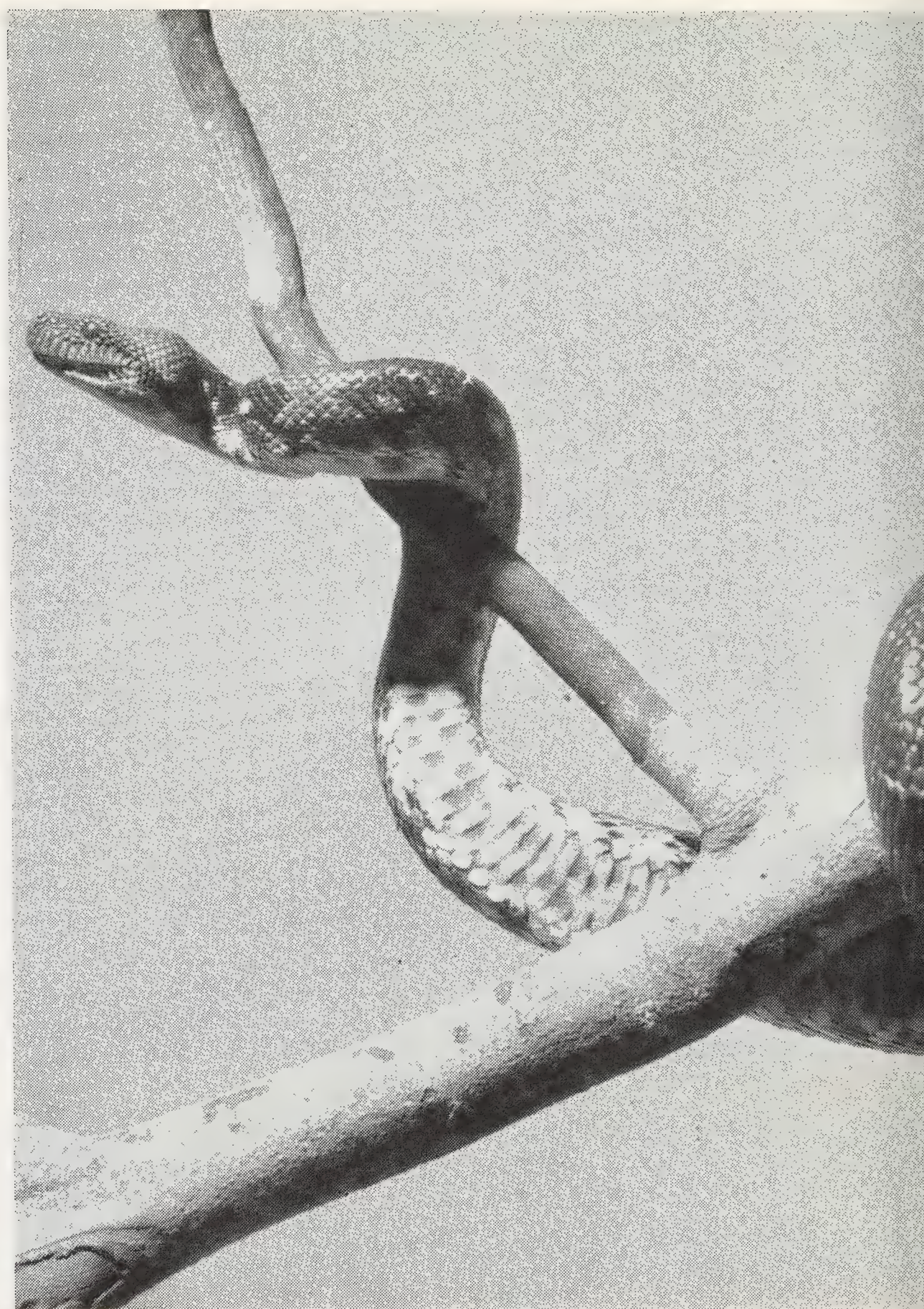
DISTANT HOME OF "AMERICAN" REPTILES

By HERNDON G. DOWLING

Curator of Reptiles

A BOA, A CHAMELEON AND AN IGUANID LIZARD came to the Zoological Park the other day from Madagascar. There is nothing especially striking about that fact — animals are likely to arrive from almost any part of the world at any time — but these particular creatures reminded me forcefully of the unusual geographic relations demonstrated by the reptiles of that island. Few places in the world have such an unusual mixture of animal life.

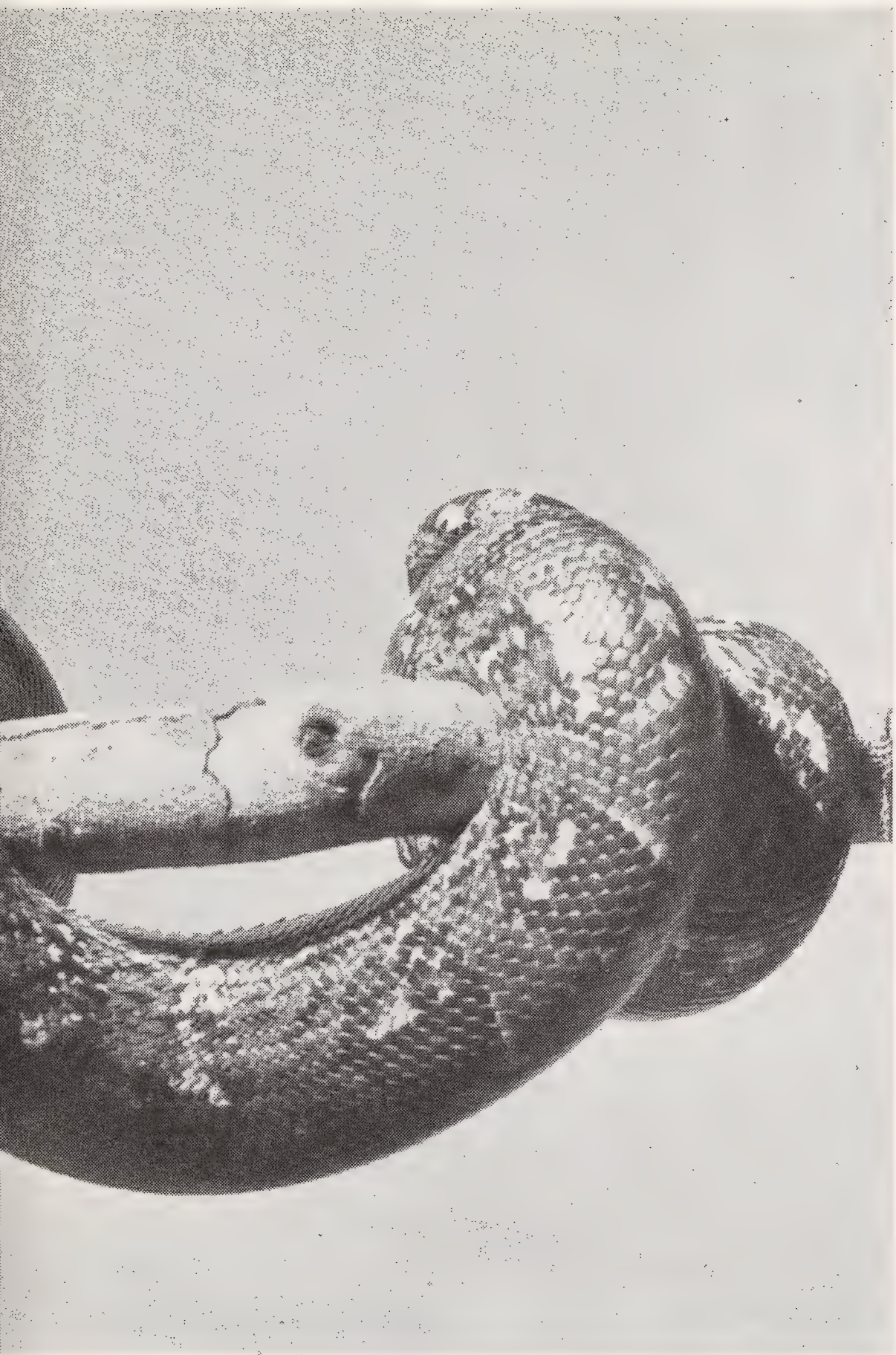
Madagascar is quite a large island, almost as big as the state of Texas. It lies about 260 miles off the eastern coast of Africa and is separated from that continent by a deep trough of the Indian Ocean. The greater part of the island is within the true tropics and although its southern tip extends below the Tropic of Capricorn the temperatures along the coast never fall below 70 degrees, giving a tropical climate throughout. It is a varied land. A central plateau with an altitude of three to five thousand feet runs the length of the island and



occasional peaks reach a height of 9,000 feet.

As would be expected on such a tropical island, there is a large variety of animals. It is not so much the variety of animal life that is its main feature, however; it is its difference from nearby Africa. True, some of the animals have African relationships. But many have relatives in widely separated parts of the world. Nowhere is this better seen than in its reptile life.

Most of the reptiles have no obvious African relations and there are many African groups that are not represented on Madagascar at all. The absence of cobras and their relatives and even of the omnipresent vipers gives this island a feature that it shares with Ireland and Cuba — the total absence of dangerously venomous snakes. Softshelled turtles and common pond-turtles are likewise absent. Less expected and less explainable, though, is the absence of several lizard families that are found on the adjacent African coast — agamids, lacertids, amphisbaenids and



others — and which ordinarily are good “island-hoppers.” Even monitor lizards and pythons have, somehow, not found their way to these shores.

However, there are boas. Boas are typically American. None of this group is found on the African mainland, yet here on Madagascar there are three — halfway around the earth from their American relatives. Not so long ago these Madagascan boas were considered so closely related to our own American Boa Constrictor that they were placed in the same genus. Later workers have put Madagascan boas into different groups but even so they do not seem any more different from American boas than some of these do from each other. As other reptile relationships are studied, we find that this is not a unique situation but one of the typical Madagascan distributional patterns.

The Leguan Lizard shows this strange pattern too. It is one of seven species of spiny-lizard-like iguanids found on Madagascar. Other members of the family Iguanidae are found only in the

The Madagascan Boa (above) and Boa Constrictor of tropical America are strikingly similar in appearance. There are some differences, but no greater than exist between various kinds of American boas.



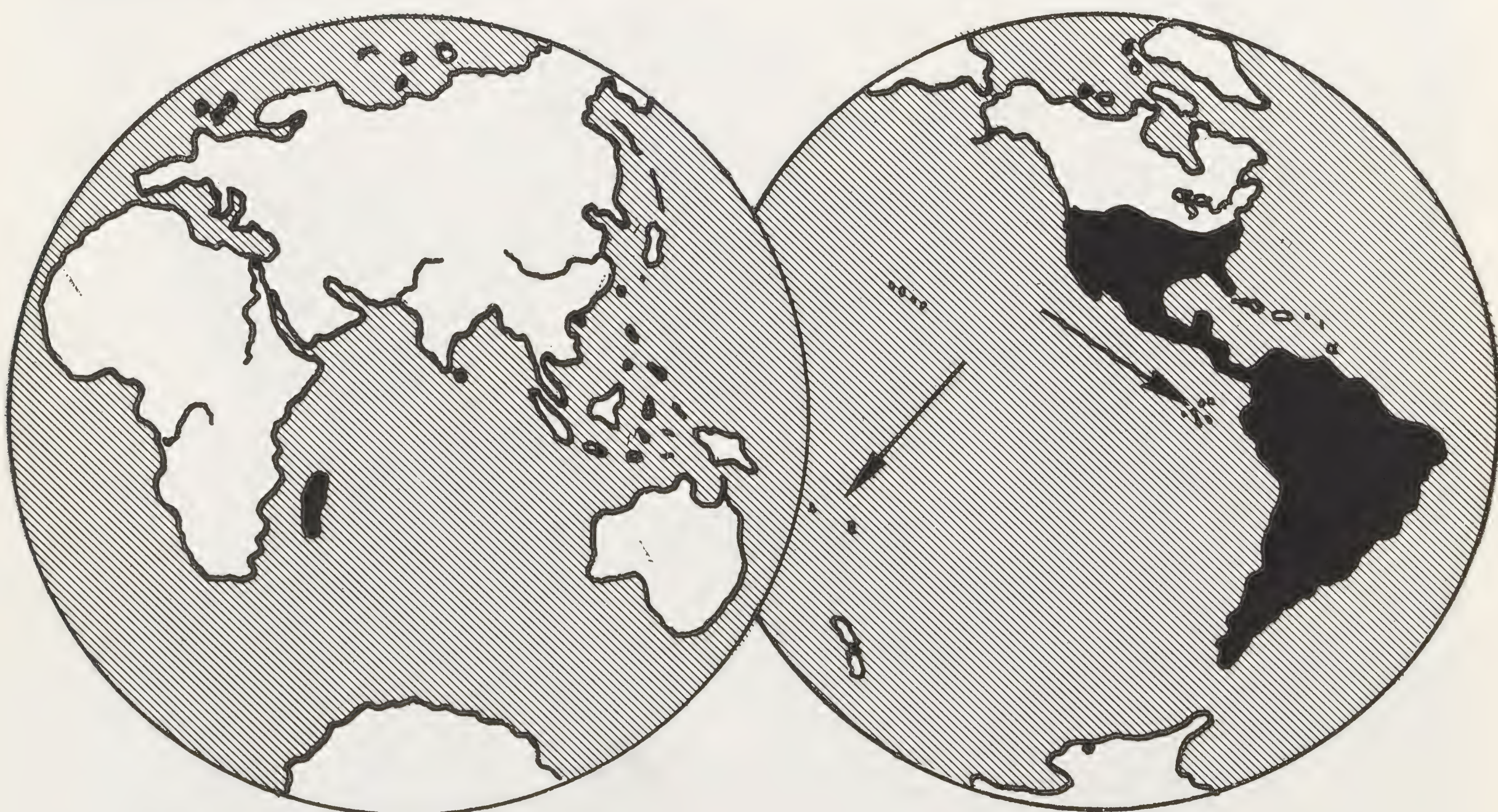


Americas — except for a single species that occurs on the Fiji and Tonga islands in the middle of the Pacific Ocean! If many animal distributions showed as little regard for geographic probability, zoogeographers, the zoologists who study animal distribution, would have reverted to some more promising profession long ago!

Most Madagascan turtles seem to have at least distant relatives on the African continent, but here too we find at least one unusual distributional pattern. The side-neck turtle genus, *Podocnemis* (unfortunately it does not seem to have any recognizable common name), is represented by seven species in the Amazon-Orinoco River system of South America — and by one species in Madagascar. None is found elsewhere in the world.

Turtles, because of their larger and more massive bones, are more likely to leave fossils than are lizards and snakes. When we examine this fossil record, the present distribution of *Podocnemis* becomes more understandable — and perhaps gives a clue to the others. Fossils show that this group of turtles was distributed over a much

Iguanid lizards are found only in Madagascar, Fiji and the Americas. Our Blue Spiny Lizard (left) and the Leguan of Madagascar are amazingly similar not only in color pattern but in basic structure also.



more extensive area in the past. They occurred on the African mainland, and perhaps throughout Asia and North America, as recently as the Pleistocene ice ages. Thus, the widely separated spots of distribution that we see now are merely the refuge areas where this particular kind of turtle survived the ice age, its relatives having died out elsewhere.

This may also be the explanation of the boa and iguanid lizard distributions (similar patterns are shown by the typically American cricetid rodents) but we have to be careful not to over-use this apparently simple explanation. The queer geographic patterns are sometimes caused by erroneous assumptions of relationship.

Fortunately, some of the Madagascan animals do have clear and unquestionable relationships. One such is the Giant Madagascan Chameleon just received at the Reptile House. This spectacular lizard is clearly related to the chameleons found on the African mainland. About thirty kinds of chameleons are found on Madagascar and, aside from a single species (or group of closely-related species) that ranges from North Africa across southern Asia to India, *all* of the others (some 40 to 50 species) are strictly African.

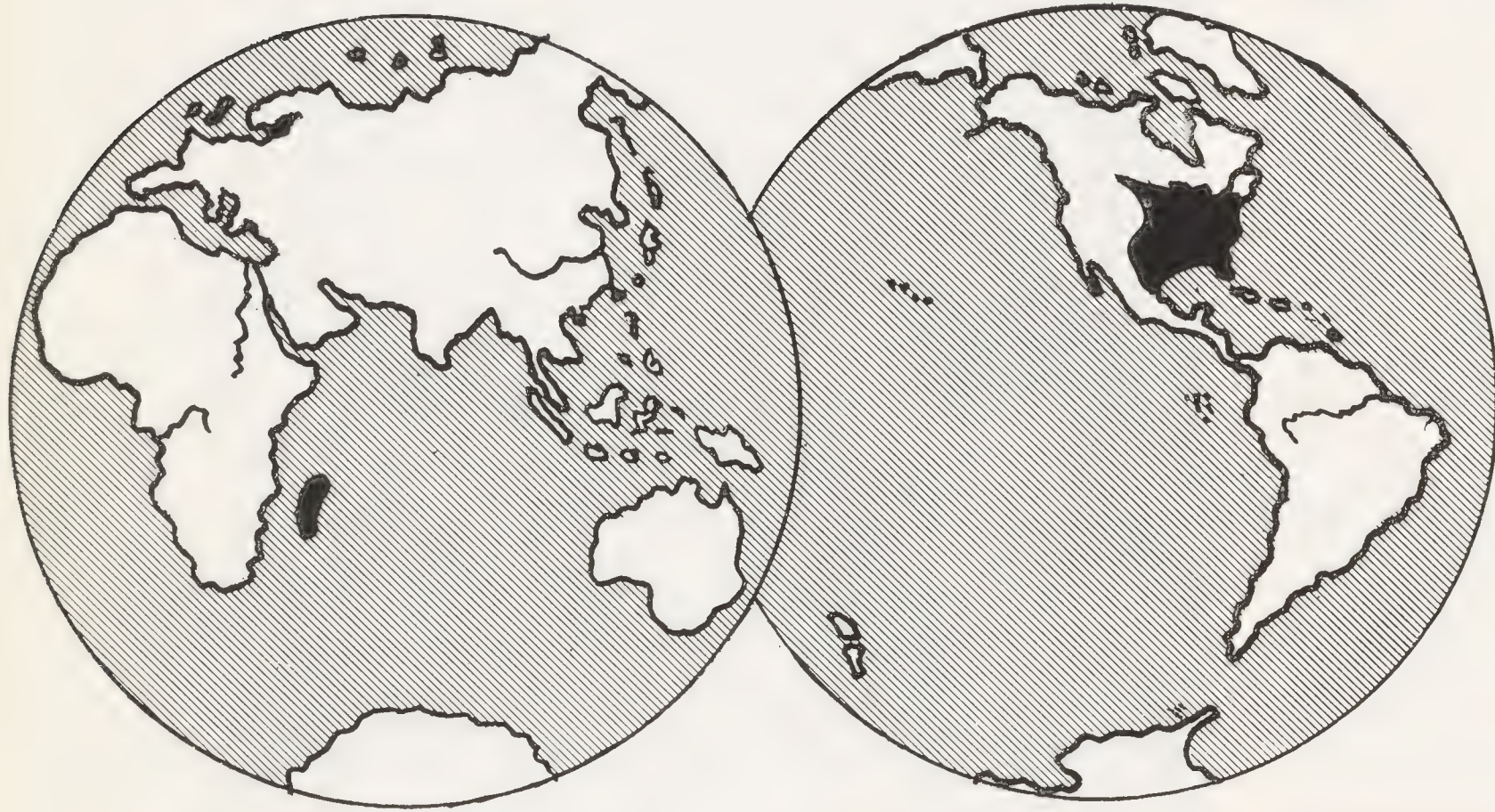
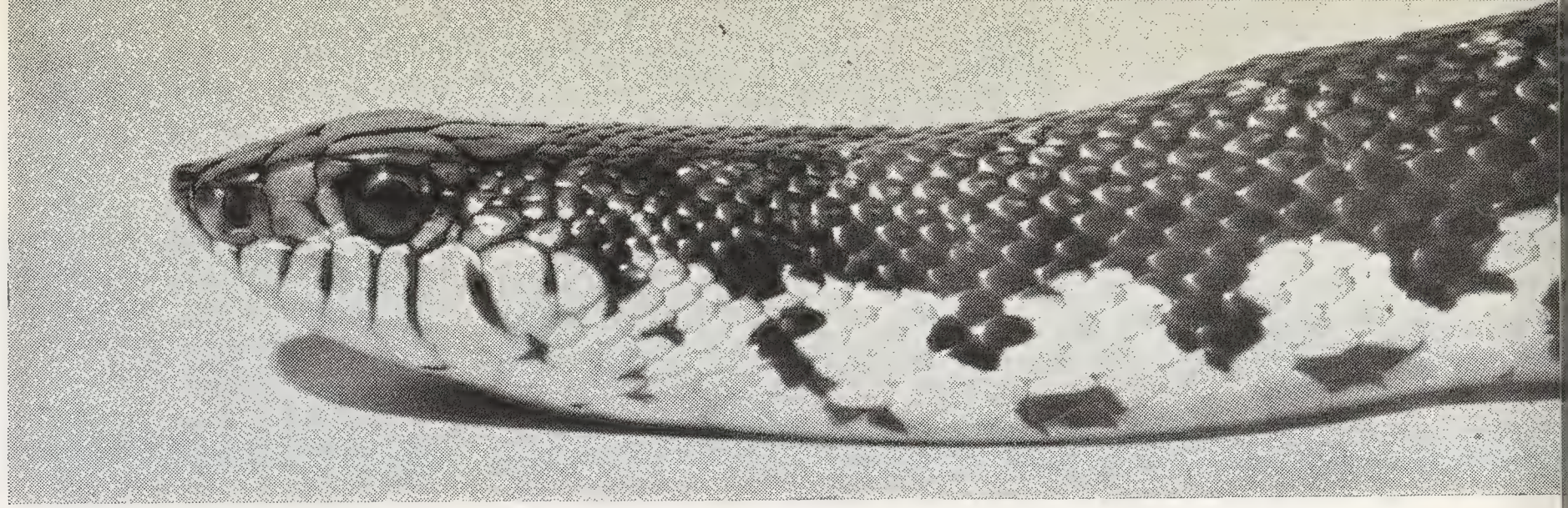
A similarly simple geographic picture (though not a particularly informative one) is presented

by the Green Geckos (*Phelsuma*). We have five of these lovely red-spotted green lizards. About eighteen species are known and all of them inhabit Madagascar or one of the nearby smaller islands (Comoros, Seychelles, Mascarenes) in the Indian Ocean. Geckos are usually nocturnal animals but these have taken up a strictly diurnal (day-active) existence. Here, on these islands, they have assumed the same ubiquitous position as the anoles do in the American West Indies.

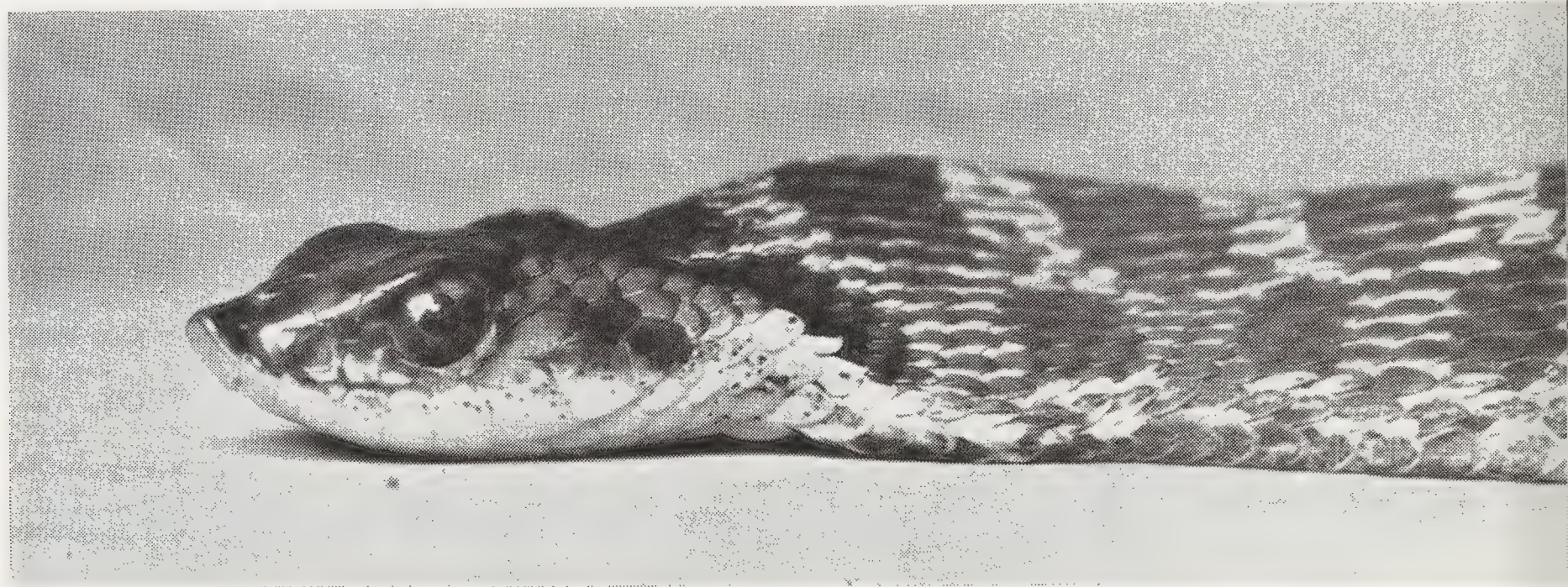
For such distantly-related lizards, these similar habits have precipitated an unusual amount of similarity in structure. In both cases the lizards are small, rather dainty in body form, insect-eating, mainly green but with considerable ability to alter that color, and having toes with specialized pads for climbing smooth surfaces. In this particular case the lizards in the two geographic regions are of different families (Gekkonidae and Iguanidae) and have so many structural differences that there is no suspicion of close relationship. Such is not always the case, however.

In some reptile groups there is so little information available about genetic relationships that we cannot make even an educated guess as to the actual source of the Madagascan reptile life. Our Madagascan Hognose Snake is an example of this. In its general body form, in the two long





Knowledge about relationships of snakes is so scanty that we do not know whether resemblance of the Madagascan Hognose Snake (above) to the American Hognose (below) is due to common ancestry or similar habits.

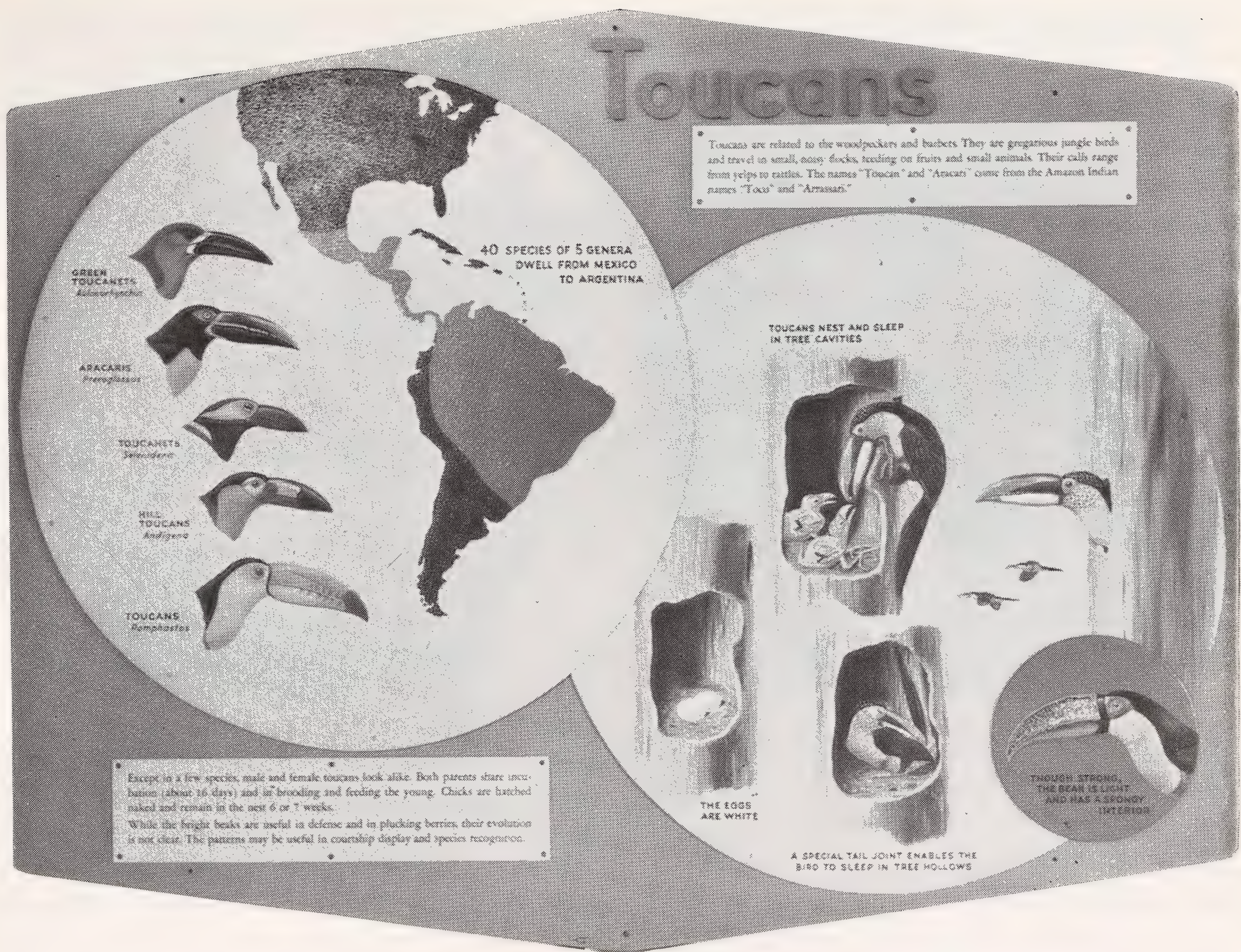


teeth in the rear of its mouth, in its pointed snout, and even in its food (frogs), this snake closely resembles the Hognose Snakes of North America. Originally it was placed as a member of the same genus (*Heterodon*), but later workers have removed it to its own genus — one restricted to Madagascar. The reasons for doing this, other than geography, are not evident and it seems possible that the present names are a *reflection* of the zoogeographic situation rather than a good basis for further zoogeographic theory.

So in the case of this snake — and in the case of many other Madagascan animals — we just cannot decide whether their characteristics indicate true and close relationship with similar animals of the Western Hemisphere or whether these are merely analogous developments. Such

features impressed upon basically different animals by similar environments and similar habits are often difficult to recognize. As yet, the basic information is just not available.

These Madagascan reptiles and amphibians are a real addition to the reptile collection. They remind us of the many questions of kind and kin that the animal life of this island presents. The forward-looking new Malagasy Republic has placed strictly-enforced regulations on the use of its unique animal life — prohibiting completely the collection of animals believed to be in danger of extinction and carefully issuing permits for others. I know that all biologists will applaud these conservation measures — measures that include even the conservation of snakes. Would that many an older nation would do as well!



SIGNS ARE FOR THINKING

By WILLIAM BRIDGES

Curator of Publications

THERE IS A STORY — and some reason to believe it is true — that at one time the director of a small American zoo refused to put identifying labels on his animal exhibits because, as he said, "People will look and look, and finally they'll say, 'Now, I wonder what that animal is?' It makes 'em think!"

This might be described as the cold turkey treatment of addicts to zoological information, and fortunately the method was never widespread. Thinking is all right; we are currently exploring ways of nudging our own visitors into a minimum of independent thinking. But we *do* give them a few clues, and if they choose to disregard the

nudges entirely they are none the worse off, for we aim to maintain a neatly printed label on every living exhibit — a label that gives not only the common and scientific name of the animal but its geographic range and a few lines about its habits. That is the minimum we, and most zoological parks, provide; often the labels are much more general and informative, some of them running to several hundred words.

Recently we have been doing fresh thinking about the many ways of telling visitors something about animals and their way of life. The best way, undoubtedly, is to *show* them — show them the animal doing the significant thing. It is not

lives under red light and in complete disregard of the clock and the sunlight out of doors.

The demonstration of such a simple concept as "nocturnal" and "diurnal" will be carried further in the World of Darkness Building now on the drawing boards, and which Director Conway will describe in more detail in the next issue of *Animal Kingdom*.

Or take bird flight — the aerodynamic principles that permit some birds to soar and condemn others to fluttering flight. They could be explained and illustrated by drawings in a lengthy label — and no doubt we will prepare just such a label — but nothing takes the place of an actual demonstration of soaring at eye-level. We can do it, with a wind tunnel. One is on the draughting board.

New buildings and the elaborate installations they require to carry zoological exhibition beyond mere exhibition are costly and cannot be created overnight. Like all zoological gardens, we are faced with the here and now, existing animals and more-or-less fixed installations. Until we can do more, we can at least try to catch attention by the use of color and form and eye-taking design. The illustrations of special labels and panels on these pages are a few of the score or more now scattered around the Zoological Park. All were designed by the Curators of the departments — Mr. Conway for Birds, Mr. Davis for Mammals.

Dr. Dowling has explanatory panels on the fauna of the Galapagos Islands in preparation for the spring opening of a special exhibit. All were constructed in the Zoo's own shops.

The Zoological Society, as our Members know, has a vital interest in conservation of wildlife all over the world. We all know that certain animals are threatened with extinction and that some have actually become extinct within recent memory. It seems to us that the continual threat has less chance of becoming an actuality, at least in our own country, if the public is made aware of it, and since some two and a half million people come to the Bronx Zoo every year the Zoo is a good place to begin the lesson. Hence the "Dead as the Dodo" panel and the "An Endangered Species" markers here and there throughout the Zoo. People do read them. Why else would there have been several telephone calls lately, beginning: "I saw a sign up at the Zoo, 'Dead as the Dodo.' Do you know of any books about what's happening to the animals of the world?" (We do).

Mrs. Reville, our Photo Librarian who designed the "Dead as the Dodo" panel, reports several recent orders for photographs of endangered animal species. It is a small beginning, perhaps, but the trend is encouraging.

The day is long past when all a thriving zoo had to do was exhibit a miscellaneous collection

PART ZEBRA?



NO. The Okapi's stripes and the Zebra's evolved independently, but serve the same function... concealment.

The stripes, so conspicuous here in the open, break up the Okapi's outline in patchy forest light. This is an example of

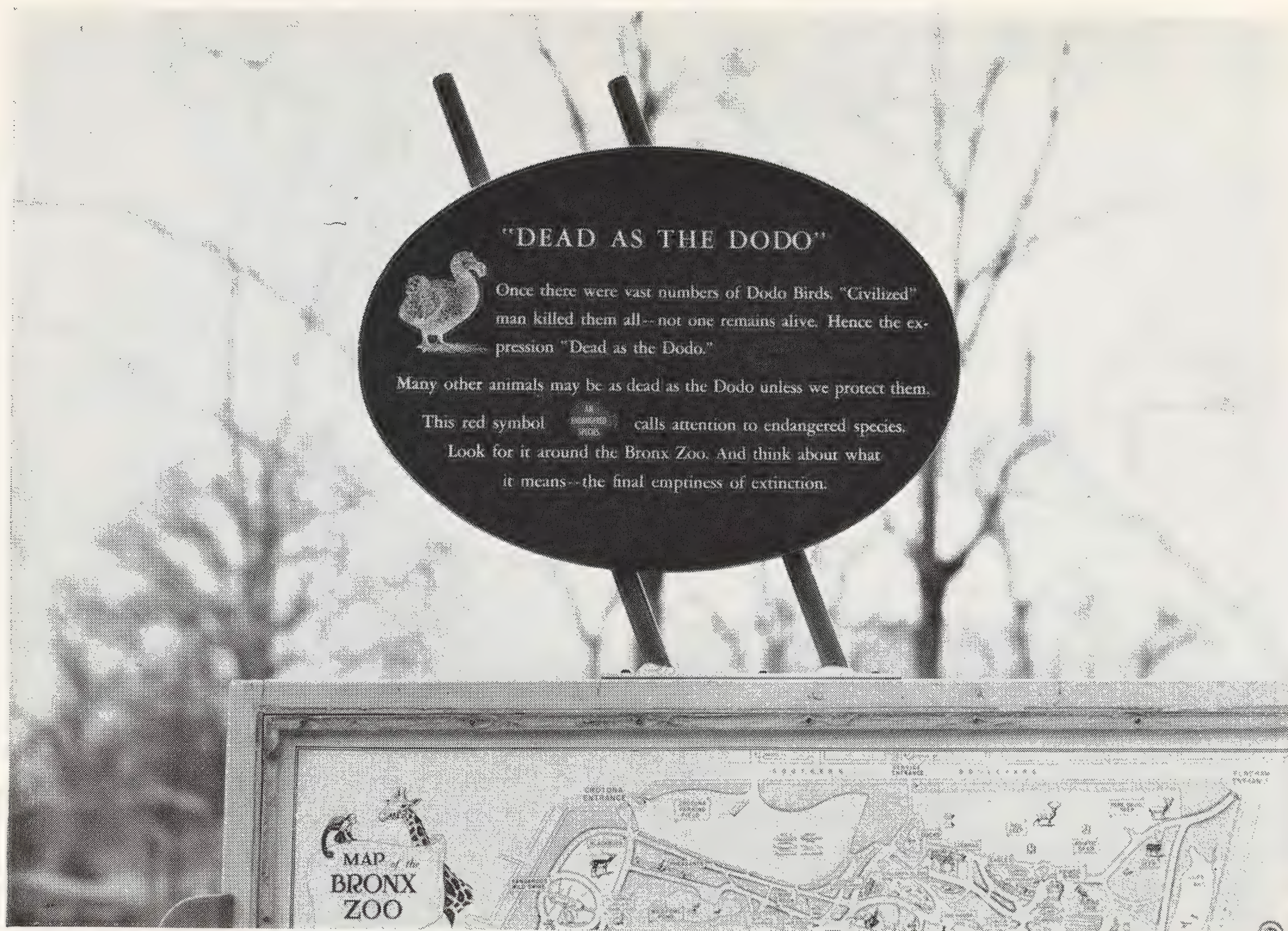
BASIC DESIGNS



All mammals are built on the same basic pattern.. The long neck of a giraffe contains only 7 bones, the same number that we have..



A typical bird, the pigeon, has 14, making its neck more flexible than that of a mammal.



of queer animals from distant parts of the earth. Today's children, even very young ones, know a good deal about the temperaments and habits and habitats of many wild animals — indeed, we have been told that many zoo-going New York children know more about exotic animals than they do about the native American species. Many years ago — as early as 1945 — we took the lead in encouraging an interest in natural history by establishing Question House in the center of the Bronx Zoo, where any visitor could walk in with a question about natural history and get an answer from trained zoologists. Question House is still a much-used function of our Education Department. Through lecture tours of the Zoo on the "Tiger Trains" in summer, and through the Talking Story Books (which deliver a minute-and-a-half talk on specific animals by turning a key), and through a new series of simple educational motion pictures we plan to make this coming year, the Zoological Society is reaching an ever-wider audience. It is perhaps too much to hope that every member of it will go away with a new concept of animals. But some will.

26

"Another Concept of Animals" has been reproduced as a broadside, 8½ x 12½ inches, and is available at the Zoo at 5 cents each.

ANOTHER CONCEPT OF ANIMALS



We need another and a wiser and perhaps a more mystical concept of animals. Remote from universal nature, and living by complicated artifice, man in civilization surveys the creatures through the glass of his knowledge and sees thereby a feather magnified and the whole image in distortion. We patronize them for their incompleteness, for their tragic fate of having taken form so far below ourselves. And therein we err, and greatly err. For the animal shall not be measured by man. In a world older and more complete than ours they move finished and complete, gifted with extensions of the senses we have lost or never attained, living by voices we shall never hear. They are not brethren, they are not underlings; they are other nations, caught with ourselves in the net of life and time, fellow prisoners of the splendour and travail of the earth.

From THE OUTERMOST HOUSE by Henry Beston. Reprinted by permission of the author and Holt, Rinehart and Winston, Inc.

Songs for All Occasions

By EDWARD A. ARMSTRONG

St. Mark's Vicarage, Cambridge, England

NO LONGER IS IT POSSIBLE for poets to romanticize the songs of birds and write sentimentally about the tender feelings which earlier writers liked to imagine these songs expressed. Eliot Howard, writing during the early years of this century, confirmed the findings of a number of previous ornithologists that birds sing in defense of territory. This is now so widely accepted that it is commonly assumed by people with an interest in natural history, and even by some ornithologists, that we can speak of bird song as synonymous with territorial song. This is far from being true. Territorial song is only one type among many forms of song. We are not concerned here with the differences between the song-patterns of different species, or even individuals, but with the range of types of song elicited by, and significant in, certain specific situations. A bird's repertoire of songs and calls constitutes the "language" by means of which it influences other individuals. It would be surprising if birds, having evolved such a highly elaborate means of communication as song, were to use it in only one kind of situation — when the individual is in occupation of a freehold and defying rivals. Song is not restricted in any such way. Various species have adapted their songs to serve a variety of functions and these non-territorial songs are of very great interest.

The familiar full song, or territorial song, of most birds possesses, as is well known, the double capacity to deter rival males and to attract the unmated female. But either of these characteristics may become accentuated and the nature of the full song may be so modified that the type of song uttered becomes almost or entirely a vocal threat or, on the other hand, loses its threat significance so as to become simply and solely a courtship song. The English Robin sings and defends territory almost throughout the year,

modifying its song to a more reflective, less vehement utterance in the fall. This species is aggressive and intolerant, expelling intruders from its territory in winter as well as spring. When an altercation develops between two males, they puff out their red breasts, square up to each other and sing snatches of a strangled, confused form of song. Such song, which is characteristic of a number of pugnacious species, may be called "fighting song" or "belligerent song." In most species it is recognizable by its being a distorted, congested version of territorial song and by its use when two birds are engaged in close-up defiance. It is recognizable as a distinct type of song with the specific function of defying an adversary at close quarters.

At the other end of the emotional scale, courtship songs are uttered by passerine birds when a male and female are close to each other in a sexual context. Such songs are commonly subdued, indeed they may be so quiet as to be inaudible more than a few feet away. To our ears some of them are among the most beautiful of bird utterances. Indeed, it might be claimed that they are unsurpassed in the whole realm of nature for their musical and sentimental appeal. It should not be lightly assumed that it is "natural" for birds engaged in wooing to sing sweet songs. On the contrary, it is remarkable that birds and men alike should express amorous feelings in low, sweet accents. This can hardly be mere coincidence, any more than it is likely to be coincidence that apes and men droop the corners of their mouths when dejected, and that, when in misery, birds and human beings alike are apt to utter notes with a falling tone.

The beauty of courtship songs is often greatly enhanced by their being the accompaniment to lively or peculiar movements and postures. The cock Rose-breasted Grosbeak poses in front of the

female and sings a sweet, subdued, continuous, varied song, dancing here and there like a great butterfly, showing off his black and white wing feathers and pink underwing coverts. The female Cardinal may sing when being courted and may use her song to attract the male to her. While courting, both cock and hen Bluebird may warble excitedly together. The King Bird of Paradise performs an amazing song and dance, spreading and waving his gaudy wings, puffing out his white lower feathers and displaying his marvelous side-plumes. The spiral tips of the long "tail-wires" dance above his back and all the time, with mouth wide open showing the apple-green interior, he gurgles forth a skylark-like song. Courtship songs are not confined to brilliantly-colored birds. The European Hedge Sparrow and the Starling sing softly while courting. A number of birds sing while copulating or just before or after the act.

The territorial song, as we have noted, indicates to the questing female where the male is to be found, but a modification of it may be used to attract the female, when she has entered the male's domain, to the nest-site he has chosen or the nest which he has prepared while awaiting her arrival. A considerable number of birds utter such nest-invitation songs and calls. They are particularly characteristic of species which nest in holes. The kind of cavity required by some species is often rather hard to find, so if a cock can secure such a site he is more likely to obtain a mate than a bachelor, however eligible, who cannot offer his intended a suitable dwelling. Unmated owls of a number of species perch, calling, by the nest-cavity and some species may even bring the carcass of a small animal to the recess, thus making the proposed nesting-place more attractive. Not only is a suitable apartment provided but the larder is already stocked. When an English Sparrow is observed on a house gutter chirping monotonously from one perch he is advertising his possession of a nesting niche and seeking to lure a mate. The European Redstart and Pied Flycatcher perform more elaborate nest-invitation ceremonies. The male flies to the nest-hole when the female is in the neighborhood, clings or hovers in front, sings a soft, jumbled song and pops in and out. The white forehead and ruddy tail of the Redstart, and the black and

white coloration of the Pied Flycatcher, render them highly conspicuous while engaged in thus introducing a female to the nest-site and so they are the better able to draw attention to it. The House Wren utters a modified territorial song as he excitedly leads a prospective mate to a nesting-box. The Winter Wren's introduction of a female to her future domicile is a ceremonial of extreme beauty although the birds are so soberly colored. Singing very softly and sweetly, he lures her through the woods, perching here and there on twigs and rapidly shaking his half-open wings. When he arrives where he has built a nest in some snug cranny he warbles outside and suddenly darts within. Emerging, he sings again with quivering wings. The hen creeps nearer and at length ventures to inspect the nest. If she is satisfied with its situation and interior she soon begins to line it with feathers. In some species of weaverbird the cock constructs a beautifully woven pendant nest and then calls with fluttering wings at the entrance or near by to attract the female. There are a number of species, such as the Snowfinch of continental Europe, in which the male does not prepare a nest beforehand but accompanies his mate on an excursion while they look for a suitable niche. When the cock enters a cavity which appeals to him he may utter a quiet song which could be called a "nest-prospecting song."

Song while nest-building is rather unusual as such behavior would tend to betray the position of the nest to predators, but the Goldfinch and Lawrence Goldfinch warble while busy on the nest and the Winter Wren sings in snatches in intervals of nest-building activity. In some species of woodpecker the male attracts his mate by tapping inside the nesting hollow and when she arrives they participate in a duet of mutual tapping at the nest entrance.

Incubation-song is also uncommon but some species of crow croon gently while on the eggs, and nests of the Goldfinch and Warbling Vireo may be found by naturalists who listen attentively for the song of the sitting bird. The Catbird sings on the nest and the female Brown Thrasher may utter a feeble song as a signal to the male. Female Cardinals carol on the nest. Quite a number of birds utter signal songs while nesting, conveying information of their whereabouts to the

mate, and in some species such songs are so closely associated with the change-over on the the eggs that they may be called "nest-relief songs."

Song closely associated with the tending of the nestlings is rare. At this stage the parents are usually fully occupied with domestic chores and the contents of the nest are most vulnerable, due to the chances of the parents' movements back and forth or the calling of the young attracting the attention of marauders. However, the Gray-capped Flycatcher of Central America sings a feeding-song and the European Wren, and probably the Winter Wren, which is another subspecies, utters extremely quiet outbursts of twittering as she stands over the newly-hatched, blind, nestlings with food, evidently inducing them to beg. She may emit a somewhat similar twittering as she leads the young forth from the nest into the wide world. The female wren twitters thus as she settles her fledged brood into a roosting-place. In winter, when a cock leads several other wrens to a cavity or nest serving as a dormitory he utters broken snatches of song — the "rallying song."

These examples will suffice to show that song of a specific kind may be associated with almost every juncture in a bird's breeding activity. Moreover, it is probable that in certain species some of these songs may be modified to convey further kinds of information. Thus it seems that the

cock Woodlark may be able to convey to his mate that an intruder is approaching by altering his song accordingly.

Undoubtedly very many more birds than is realized utter one or more of these types of song. Naturalists, especially amateurs, have a wonderful opportunity to add to our knowledge of such songs. Close study of a species is needed before we can assume that it is without a repertoire of songs for different occasions. For example, to discover whether a feeding-song is uttered by a bird breeding in a covered nest or cavity, it is sometimes necessary to make an observation nesting-box so that one's ear may be placed within a few inches of the parent as he or she feeds the young, or a microphone may be placed where such faint sounds may be picked up. Only after years of familiarity with a species may a lucky combination of circumstances lead to the discovery that it possesses some form of song specialized to particular occasions. All my life I have been interested in the Great Tit, a common bird in England, but only last year did I notice, as I sat quietly among the bushes in my garden, that the male sings a soft, sweet courtship song as he flutters around the female. Bird photographers and others who take the trouble to sit in a blind near to a nest have excellent opportunities to discover these types of song and there is a most attractive field of endeavor available for naturalists armed with tape-recorders.

News from the Conservation Foundation

CO₂ Conference

Civilization is, of course, producing a very great deal of carbon dioxide industrially and by way of exhaust gases, which go free in the atmosphere. The consensus of scientific opinion seems to be that the greater part of the carbon dioxide thus liberated finds its way into the oceans.

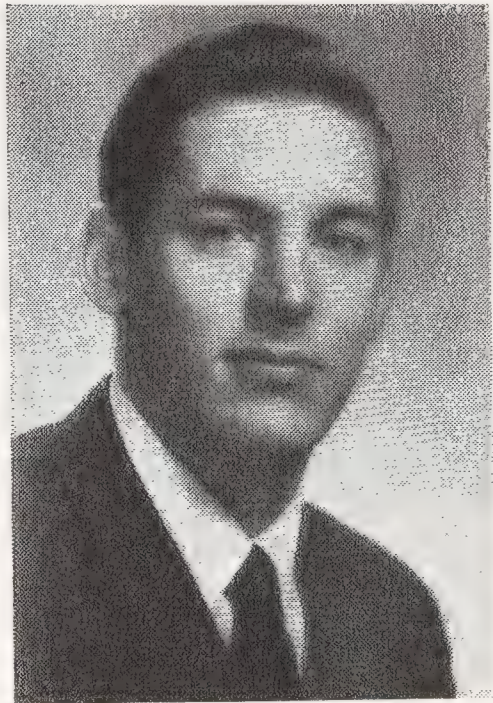
This Foundation, being concerned with the biological consequences of atmospheric pollution or change, has called a small private conference for March 12-13 at the Rockefeller Institute. Participants who have already accepted invita-

tions include F. Fraser Darling, ecologist, Chairman; Erik Eriksson, Institute of Meteorology, Stockholm; Charles D. Keeling, oceanographer, Scripps Institute, La Jolla, California; Edward S. Deevey, ecologist, Yale University; G. Evelyn Hutchinson, biologist, Yale University; Gilbert Plass, physicist, Ford Motor Company, Newport Beach, California; Abel Wolman, consulting engineer, John Hopkins; and William Garnett, photographer, Napa Valley, California.

Each participant will prepare a general paper for discussion and distribution.

John P. Milton

With great hope in ecology and even greater hope in the young ecologist, the Foundation welcomes John P. Milton as our latest research associate. Born on the fringe of the Great Swamp in New Jersey, his freshman year at the University of Michigan found him organizing an expedition into the Mount Waddington-Mount Monarch region of the Coast Range in southwest British Columbia, studying glaciology, which led in a surprising turn-about to a trip the following spring into the tropical forest of northeast Chiapas, Mexico, near the Mayan ruins of Bonampak. A discovery, previously unknown to science, of the Lacanja resulted in further trips with Dr. Lizardi Ramos of the Anthropological Institute of Mexico City College, with an account of the expedition later published widely in newspapers throughout the United States and Mexico. Exploring the previously unexplored seems to be somewhat of a hobby with John, who took off again almost immediately up north into the Logan Range of the MacKenzie Mountains just south of the Arctic Circle where detailed plant collections were made and an ecological study of plant communities surrounding a hot spring were completed.



Receiving his Bachelor of Science from the

School of Natural Resources at Michigan in the fall of 1961, John was accepted into the Graduate School to further his interest in ecology, conservation and land use. Under the wise guidance of Dr. Marston Bates and Stanley Cain, he was promptly assigned to complete two ecological projects in Costa Rica. All this, plus a report on the present status and workings of the Inter-American Institute of the Agricultural Sciences of the AOS which he developed into his Master's thesis, appears to bring up a major problem — how can John Milton be expected to be tied down very long to a desk, a chair and a room at 30 E. 40th Street, New York City?

Briefly Noted

Chairman Fairfield Osborn was interviewed by Miss Duncan McDonald over WQXR on January 17 as editor of the book *Our Crowded Planet*. He discussed the problems of population pressures . . . The Conservation Foundation is cooperating with Sargent Shriver's Peace Corps in preparing a field kit of conservation projects and pamphlets which can be carried out by volunteers in underdeveloped areas, particularly in Latin America . . . In the absence of Dr. Darling, Noel Eichhorn attended the meeting of the National Academy of Sciences' Committee on Long Range Research Needs in National Parks which was held in Coral Gables, Florida, January 10-12 . . . Wallace D. Bowman attended the Annual Meeting of the American Association for the Advancement of Science in Philadelphia on December 26 through 30.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM
AND THE DEPARTMENT OF TROPICAL RESEARCH

Milky Eagle Owl Yields An Egg Secret

Our Milky Eagle Owl has been assiduous in laying eggs, but equally assiduous in breaking them. We have, consequently, attempted artificial incubation and managed to carry one egg for four weeks before it ceased development.

Realizing that we were guessing at the proper incubation temperature, we gave the bird an artificial egg containing a thermister bulb attached to a remote-reading thermometer, and now have a "normal" incubation temperature reading. It turned out to be several degrees lower than the temperature we had maintained.

Unfortunately, the two eggs laid since then

have both been infertile, but when a fertile one comes along we'll be ready.

Anyway, One Egg Got Here

A pair of Galapagos Tortoises in the Montreal Children's Zoo were observed mating early this winter, and in December Curator Dowling received a telephone call from the director of the Children's Zoo, reporting that three eggs had been laid. Did we have facilities for incubating them?

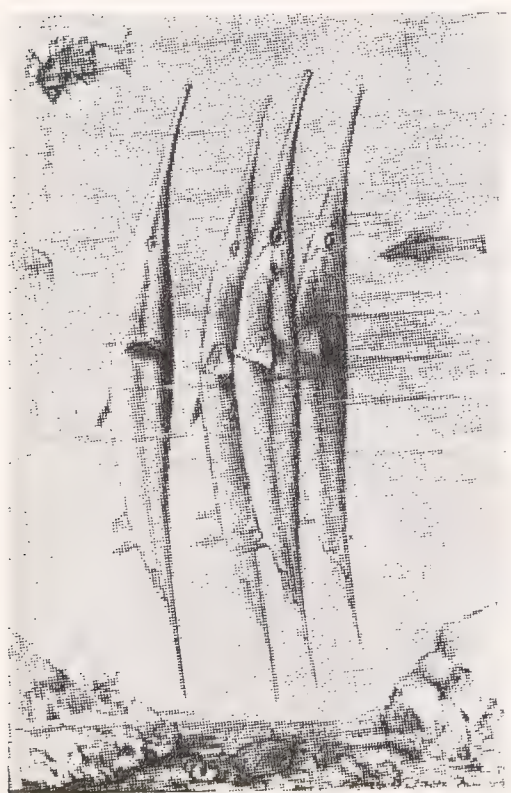
We reported that we did, and the director undertook to fly to New York and deliver them in person.

He arrived on December 14 — but with only one egg. All three eggs had been entrusted momentarily to a Montreal news photographer who somehow managed to knock two off a table, so that their shells were split.

However, we put the single remaining egg in an incubator at a temperature of 85 degrees and 80% humidity, and are hoping for the best. Incubation takes about 180 days and we will know the results early next June.

Heads Up! Heads Up!

As several observant readers noticed, a drawing of four Shrimpfish on page 176 of the November-December *Animal Kingdom* showed them swimming heads *down*, whereas the caption called for them to be swimming heads *up*. The reversal occurred through a printer's inadvertence in lifting



Heads up — the way this drawing was printed in 1902 and the way it should have appeared in the Nov.-Dec. issue of *Animal Kingdom*.

the printing block and replacing it wrongly while the magazine was on the press. Since the point of the article was the swimming position of the fish, we reprint the drawing here as it should have

appeared. (Although no one seems to have noticed it, exactly the same thing happened to the photograph of a Bananaquit on page 180 of the same issue!)

Green (Turtle) Pastures

A large area on the island of Inagua is being set aside for the rearing of Green Turtles, both as a conservation measure and as a means of restoring them as a source of food. The area will be administered by the Bahamas National Trust, with the support and scientific advice of the Caribbean Conservation Commission, under the direction of Dr. Archie Carr. Dr. Carleton Ray attended the fourth annual meeting of the Trust, which he helped to establish in 1959, and with Dr. Carr, Alexander Sprunt of the National Audubon Society and Col. Ilia Tolstoy visited the turtle area on Inagua.

IN BRIEF

Hybrid Anacondas. Twelve snakelings have been born to our female Common Anaconda collected in Trinidad in 1956 and a male Yellow Anaconda that came from Paraguay in 1958. This is the second brood for the pair, which produced young in 1959.

Dr. Osborn Appointed. Dr. Fairfield Osborn has been appointed to the Board of the New York City Health Research Council and has been made a member of the Mayor's Retirement Committee for the Cultural Institutions Retirement System.

Gull Scare. Wild Herring Gulls, which compete with our own waterfowl and cranes for their food, are a major problem which we are attempting to solve by means of taped alarm cries of gulls. Preliminary tests indicate that they are strikingly effective for frightening off wild gulls with a minimum of disturbance to our own stock.

Animal Exchanges. As part of our cooperative program for maximum utilization of breeding stocks, we have sent a female Uganda Kob to the Philadelphia Zoo, a male White-bearded Gnu to the Cincinnati Zoo and a male Axis Deer to the Franklin Park Zoo in Boston. The first two represent species which are not included in our own

breeding program. From the Pittsburgh Zoo we have received a young male Dybowski's Sika Deer to introduce new blood into our herd. This is the third time we have acquired a herd buck of a new strain since we purchased our first breeding pair in 1928.

PUBLICATIONS OF INTEREST

UNDER THE SEA WIND. By Rachel Carson. 157 pp., drawings. Signet Science Library, 1962. 60 cents.

A paperback edition of the first of Miss Carson's celebrated books about the sea, originally published in 1941.

BECKONING DESERT. By Edward Maddin Ainsworth. 264 pp., black-and-white drawings by Bill Bender. Prentice-Hall, Inc., Englewood Cliffs, N. J., 1962. \$5.95.

A long loveletter about the southern California desert, its history, animals, geology, characters.

MAINTAINING FISHES FOR EXPERIMENTAL AND INSTRUCTIONAL PURPOSES. By William M. Lewis. 100 pp., 8 text-figs. Southern Illinois University Press, Carbondale. 1963. \$5.00.

Fishes have yet to assume their proper place as laboratory and classroom animals, principally because of the difficulty people have in keeping them. This primer may help rectify the situation and is recommended to would-be experimental ichthyologists and teachers who would like to introduce their pupils to the world of water. — J.W.A.

INTRODUCTION TO MAMMALOGY. By E. Lendell Cockrum, 455 pp., The Ronald Press Company, New York, 1962.

Written as a textbook for a college-level course in mammalogy, Dr. Cockrum's book will be appreciated also by the bright high school student who is developing an interest in zoology. Roughly half of the book covers the general subject of mammalogy, with the remainder devoted to a coverage of the families of mammals on a worldwide basis. In this respect it will form a welcome addition to the library of any serious amateur zoologist.

The photographs and line drawing are largely poor, but will not interfere with the usefulness of the text. — J. D.

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THE GOOD LIFE IN THE ZOO

BY FAIRFIELD OSBORN

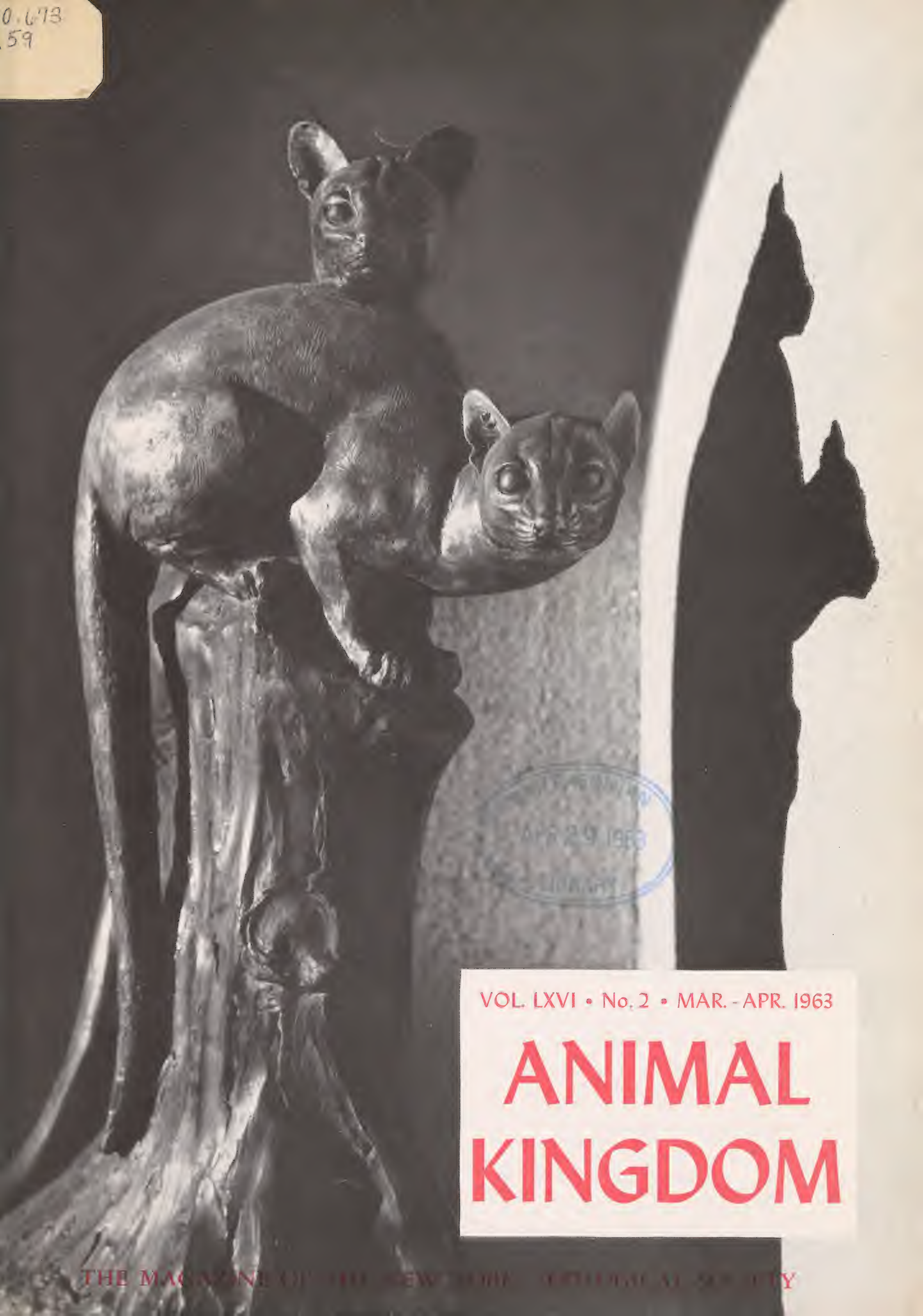
It's an article about the Bronx Zoo, and it's by the President of the New York Zoological Society. You'll enjoy it.

In the February issue of

THE READER'S DIGEST



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VOL. LXVI • No. 2 • MAR. - APR. 1963

ANIMAL KINGDOM

THE MAGAZINE OF THE NEW YORK ZOOLOGICAL SOCIETY

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ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

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*Presented by John H.
Phipps and Exhibited in
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Beyond Man's Understanding

IT IS DIFFICULT to discuss objectively a subject as tenuous and complex as the degree of intelligence possessed by animals. Man, influenced by long tradition, is inclined to believe that he alone is the possessor of intellect and that all "lesser beings," as animals are frequently called, are relatively devoid of intelligence. The capacity of animals to do many remarkable things, and especially to survive, often under rapidly changing conditions, is attributed to processes that are considered principally, if not solely, as instinctive. The word *instinct*, in turn, poses an enigma of its own because it fails to explain many things that animals do. These are often quite beyond our understanding and we are apt to attribute certain actions of animals to their sensory perception, although not being always clear as to the nature of this capacity which man does not equally possess.

Further, we question whether animals have foresight. Yet, can we be sure they lack this quality? We wonder, too, whether through the concerted actions of a group, animals are capable of dealing with an emergency. As to this, I happened to learn of the following incident while in Africa two years ago: Late one day a bull elephant fell into a deep gully or pit and was unable to extricate himself. As dusk fell his trumpeting attracted a number of elephant companions from a nearby forest. Two African game scouts happened to be in the neighborhood and determined to stay the night perched in some trees to observe the outcome. Through many hours in the darkness there was much elephant language, and finally silence. When dawn came, they found that the assisting elephants had torn away a large portion of the gully's bank, creating a ramp which enabled their imprisoned companion to walk out.

Speaking of large mammals, the construction of big oceanic pools, some years ago, such as those in the Marinelands of Florida and California, and more recently in our own Aquarium in New York, have, for the first time, made it possible to observe intimately the mental capacities of whales and their lesser relatives, porpoises and dolphins. What a revelation that these creatures of the great deeps are so responsive to learning! The fact is, the intelligence of animals is a subject that man himself does not fully comprehend — and perhaps never will.

Fairfield Osborn

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APR 24 1963

OUR NEXT STAGE OF



ANIMAL EXHIBITION

By WILLIAM G. CONWAY

Director of the Zoological Park

OVERSIMPLIFICATION is a scientific sin, but in order to introduce today's broad forward sweep of the New York Zoological Park I am tempted to commit it. Let us suppose, therefore, that in the past few hundred years there have been just two theories about exhibiting wild animals, the second quite recent.

I. People like to look at unfamiliar animals. And so we put the animals in a pit or an iron cage and let the people look.

II. Interest is heightened if we decorate the pit or the cage — if we create a "habitat exhibit," in other words.

There is an enormous difference between I and II, not only in aesthetic appeal but in the admitted purposes of exhibition. With the habitat exhibit — and many of them in modern zoological gardens are truly bits of nature transplanted — we approach one ideal of the zoo: to show the animal as it is in its own home.

We think the time has come for the Bronx Zoo to push ahead to stage III in the evolution of animal exhibition.

That is, not merely to show the animal in a segment of its home, but to create conditions under which it *is* at home, and therefore leads its own normal, unhampered life with all that implies in the way of natural behavior.

Many minds have contributed to the development plans of the Zoological Park: Driscoll (Construction & Maintenance), Crandall (General Curator Emeritus), Tee-Van (General Director Emeritus), Dowling (Reptiles), Conway (Director) and Davis (Mammals). Model on the table is that of the World of Darkness.

We can never do it with 100% completeness — we wouldn't want to. We will never turn the Lions loose to hunt their own food among our herd of antelopes! But we know we can go beyond the setting, to the life itself. Our oversimplified stage I served to show people what animals looked like; stage II showed them what the animal looked like at home; stage III will show at least some of the things the animal *does* at home.

We will try to give zoo-goers the opportunity to learn something about each animal's environment through natural habitat exhibits, to explore the mysteries of wild animal behavior, to be informed by special displays of nocturnal species, of burrowers, of strange animal courtship rites and of curious creatures of camouflage. Visitors should be able to view animals performing characteristic acts — manakins dancing, bats navigating by sonar orientation, for example — and we intend to eliminate the distractions of wire and bars through the use of moats and other invisible barriers.

A strong start has already been made at the Zoo during the past two decades and now, more easily than ever before, techniques are available to reach the new goals. At the Aquarium the new Polar Bay, and at the Zoo the Animal Nursery, already hint at the projects to come. Large and colorful signs from one end of the Zoo to the other now mark the sites of planned improvements and give an impression of the over-all Zoo scheme. Its first major building is a replacement for the old Aquatic Bird House and it will be completed this year. The steel skeleton is nearly complete and is rapidly donning a tough skin of brick.



Drawings by Walter Addison

Some months from now, walk into the new Aquatic Birds building. You will find yourself standing tree tall and looking into an active heronry. You needn't whisper — but watch closely or you may miss a nest stick presentation ceremony or even a bout of courtship display in the treetop bird colony. Of course you are not really perched in a tree in Corkscrew Swamp or Reelfoot Lake, but we've tried to give that impression, and so, rather than introduce you to the display at "swamp" level, we've brought you in at treetop level for an unusually intimate look at the bird's arboreal realm. You are looking at exhibit #1 and, if you follow the natural flow of the carefully planned circulation pattern in this new structure (designed by Architects Harmon Goldstone and Eustace Dearborn), you'll wander through a short but delightful maze from "The Treetops" to a "Tropical Lagoon," past "The Shore" and the "Sea Cliffs" to a replica of a living marsh and a segment of one of the fast disappearing but incomparable deep Southern swamps. As you confront one exhibit, you will be fixed by the clear impersonal eye of a brilliant Saddle-bill Stork while, further on, incredibly long-toed Jacanas will skitter from one floating waterplant to another.

Mostly, the only barrier that separates observer from birds in this new exhibits building is the visitors' self restraint. Where we have had serious doubts there is glass; no wire, no bars.

These exhibit ideas are not all new or untried.

Most have been tried experimentally or adapted from successful exhibits elsewhere.

We hope the exhibits in the Aquatic Bird House will provide windows to some of the fascinating and characteristic places where birds are dependent upon wetlands for homes and foods. We hope to create a better understanding of the interdependence of "habitat and heron." The actual number of kinds of water birds on exhibit may be no greater than in the 1899 Aquatic Bird House, for we will attempt to do much more than



just show what kinds of birds there are. We are trying to show what they do, or don't do, where they live, where they go . . . and why.

These new exhibits will be an esthetic experience as well as a natural history eye-opener, but for this the planners can take little credit. It is hard to compete with "artists" who work in iridescent kingfishers and breath-taking flamingos and who think nothing of employing a touch of egret or a splash of auk.

At the Jungle Stream, the visitor will be confronted, for example, with a waterfall plunging down through a tangle of verdant growth. Finfoots skulk the shallows and shimmering kingfishers make sudden swoops over the water; dipper dry off on protruding rocks between underwater forays. A few feet away, in strong contrast, murres, puffins and auklets will be gathered on as bleak a cliff as breaks the waters of the sub-arctic (or as bleak as fiberglass and artifice



As he enters the "World of Darkness," the visitor is confronted by two identical forest exhibits; each leaf and every twig, each stone and tree — identical. But in one forest the diurnal chipmunks are active, and in the other — which by the way, is lighted with red lights — they sleep. In contrast, nocturnal flying squirrels snooze quietly in the "Day" exhibit but actively make sleep a trial for the chipmunks in the "Night" display. With the theme established, the observer passes on beneath the words "The Forest



can contrive!) and the observer will be able to watch the famous "underwater flight" of auks.

FOR HALF of our lives we dwell in darkness and half of our planet is always dark. Darkness and mystery, superstition and a fear of the unknown are often associated, and that vast host of creatures which sleep by day but prowl by night have acquired, in human imaginations, an aura of unreality and mystery bordering on fear — and in actuality, senses and adaptations bordering on the uncanny. Nocturnal birds, mammals and reptiles are the subject of an entirely new building we are planning, "The World of Darkness."

Growing out of experiments by Mammal Curator Joseph Davis, the new building will employ activity reversal schemes and other special techniques to show night creatures, which normally sleep during the day, actively living in natural habitat displays. In months of meetings, the three animal curators have developed, with architect Morris Ketchum and Associates, drawings and specifications for one of the most exciting live animal exhibit buildings ever planned.

After Dark." Ingenious lighting techniques will permit an intimate glimpse into a tropical jungle at night, where the light-gathering eyes of night creatures are seen in strange faces, here and there one whose strangeness is even frightening. Oil-birds and owl monkeys, geckos and vampires, galagos and pottos, frogmouths and whip-poor-wills, aardvarks and pangolins, cat-eyed snakes and vipers, flying phalangers and fennecs, eagle-owls, even clouded leopard, all may be seen in that remote life to which each dawn means curfew. "Wings in the Night" warns another title, and the observer may watch owls and phalangers in action and perhaps see fishing bats scoop up prey from a pond in a long, glass-fronted demonstration display. "Refuge Underground" introduces a complex of cave and burrow exhibits where such creatures of eternal darkness as cave fish and blind salamanders can be seen and where burrowers, from prairie dogs to gopher tortoises, are exposed in their intricate underground re-



treats and where desert and forest homes are compared side by side.

“WINGS AROUND THE WORLD,” “The Mating Instinct” and “Secrets of Bird Life” are not book titles or travel advertisements but introductory signposts to some of the major halls in the new “World of Birds.” It will be the first new animal building on the Zoo’s main Court since 1905, and will replace the Main Bird House which was opened in that year. The titles are fanciful, to be sure, but they announce stages in one of the most exciting journeys (and certainly the most convenient one) that any wildlife enthusiast has ever made.

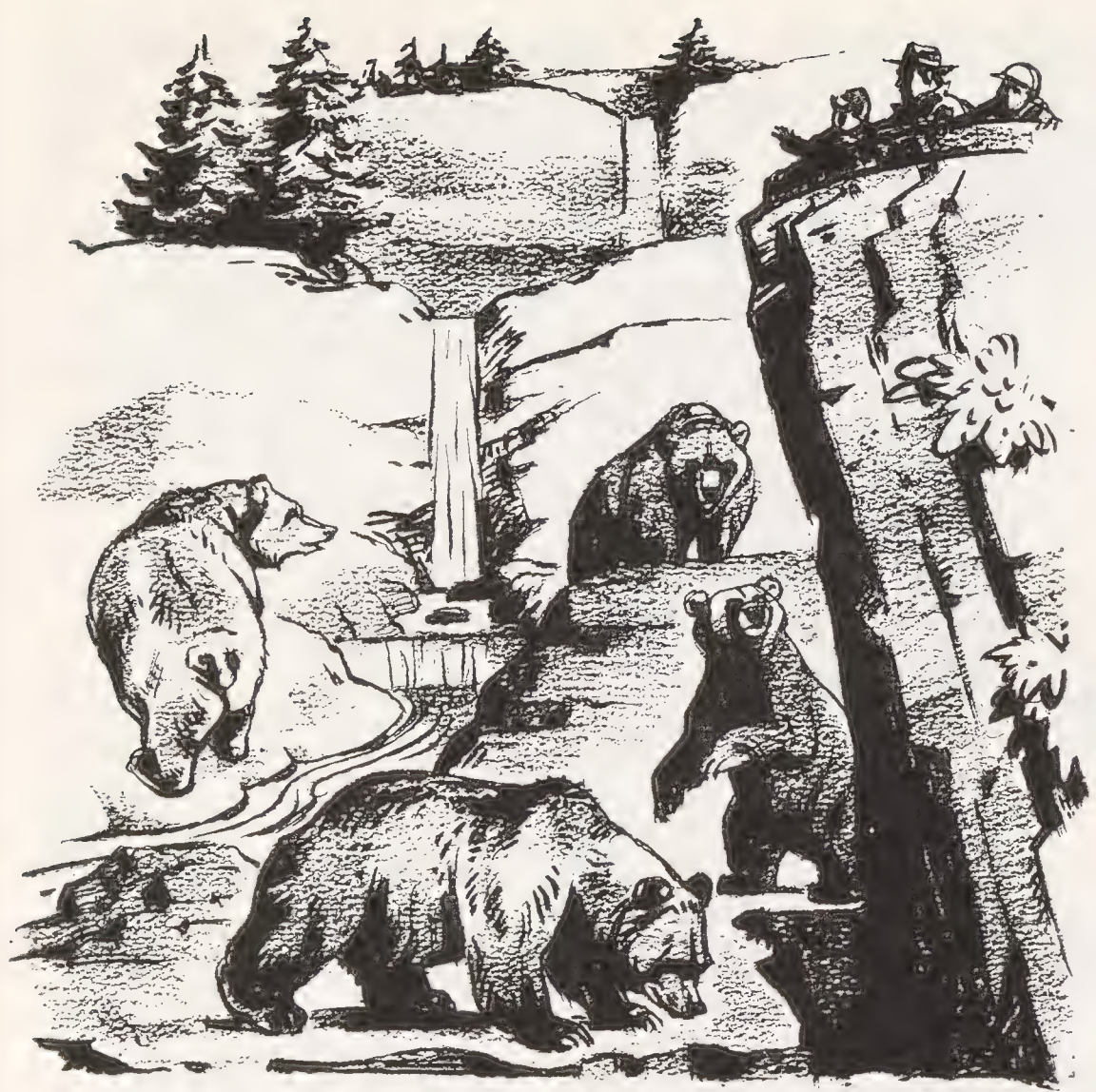
The “World of Birds” is now well along in



preliminary design by the architectural firm of Eggers and Higgins. In it the visitor will be led through a series of geographic exhibits that review bird life from “down under” to his own New England yard, from southern desert to boreal tundra, and even from spring and summer to fall and winter. He will walk into and through an Old World jungle; he will watch exquisite New World tanagers, honey-creepers, cotingas, hummingbirds and trogons as they swoop through the sudden mists of a New World tropical rain forest. In a long hall where the light is subdued, glass windows (if there are any barriers) open upon the incredibilities of a bowerbird’s courtship bower, the frenzy of a manakin’s dancing arena, the disorganized communal life of a colony of giant caciques and the strange social nests of “quaker” parakeets. Birds of paradise will be given the opportunity to set up courtship display areas and an entire weaverbird colony will be induced to build one of their vast community nests. Still other displays will explore the mysteries of migration and celestial navigation and introduce the observer to demonstrations in the living stuff of evolution and adaptation.

Most of the exhibits will be large and open and present the birds in simulated natural habitats where they may be properly appreciated in relation to their own world rather than ours. Educational signs will be colorful graphic presentations, not dry lengthy labels, and a wealth of illustrative material such as nests and eggs will be shown rather than just written about.

EAST OF THE PENGUIN HOUSE, a great gray-black ridge of stone shoulders its way through Bronx Park’s soil and looms primitively over the surrounding walks and old iron-barred Bear Dens. The rock mass is marred by the remnants of earlier bear dens and shelters which still stand against its flanks, but since Fall a colorful sign has proclaimed “Look, Mom! No Bars! Bears!” We are now preparing plans to rip out the unsightly old steel bear cages, to return the entire west face of the rock formation to its original state, and to make a dramatic barless display for Alaska’s great Brown Bears, “the earth’s largest living land carnivores.” Of course we can’t bring a piece of Alaska along, but it happens that we have an extraordinary Bronx substitute in our natural stone, and a waterfall and a good-sized



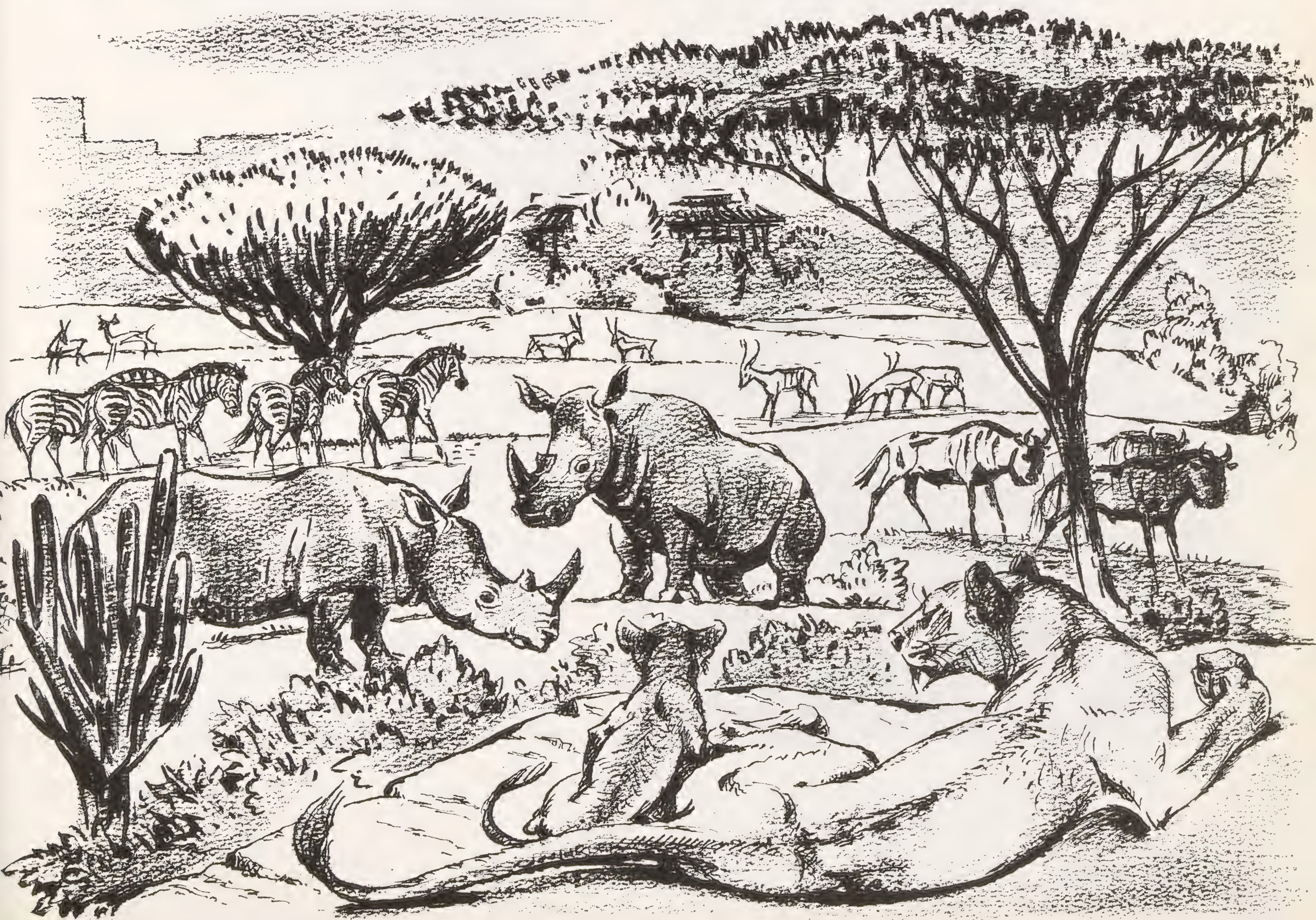
stream have been planned to complete the picture. A hidden moat will give the observer an unobstructed view and a narrow glass window will provide, for the first time, a peek into the bear's stone den. At the same time, the display will act as the introduction to a new zoogeographic exhibit complex, "Holarctica," and the zoo-goer will proceed through an entrance-way down into a long valley which will gradually be

flanked by North American, North European and North Asian exhibits.

On the site of the present Polar Bear enclosure, backed by the other side of the "Big Brown's" spectacular natural cliff, a barless display will be created for the great white bears. These huge semi-aquatic bears are dwindling in the wild and much thought has gone into the planning of breeding facilities. Naturally, a large pool will be included.

Twenty-two years ago this fall, a gift from an anonymous donor made the realization of a long cherished Zoological Society idea possible and the "African Plains" was built. It has been widely copied, for it truly gives the zoo-visitor more than a little of the flavor of wild African creatures in their own homeland. Furthermore, it shows predators in relation to prey. This lion and antelope exhibit is a wonderful start, but incomplete. We now hope to complete the zoogeographical display started in 1941 by developing most of the remaining parts of the south end of the park as "Africa." The completed exhibit will be a complex of hidden moats and careful landscaping to make a total of nearly 15 acres appear, in effect, a piece of African wilderness.

In the distance can be seen gnus and zebras,



side by side, and near them a pair of huge White Rhinoceroses, standing as tall at the shoulders as a man. A Lioness, surveying the scene, takes her attention momentarily from her cubs to listen to the distant roar of another Lion. Concealed loud-speakers add the far-off calls of typical mammals and birds. Nile Hippopotamuses frolic with ponderous grace in an African river among cormorants, geese and pelicans, and storks wade in patches of marsh near the river.

To the west, the Plains will give way to brushy terrain for Mountain Zebras and our Lesser Kudu herd. Hidden in this area will be the winter quarters for the animals. At the crest of the hills, brushland gives way to thicker forest where Okapi, Bongo and Congo Buffalo move through dappled sunlight.

Passing through the forest area, the visitor will return to brush country where he will view at close range a group of Greater Kudu, and a troop of baboons, mingling freely with Barbary Sheep. Back on the plains, gazelles cavort within sight of a pack of Cape Hunting Dogs, against a backdrop dominated by the giraffe and elephants. Perching in a tree nearby, vultures survey the scene. We have the animals; we have the ideal terrain to exhibit them in these dramatic ways.



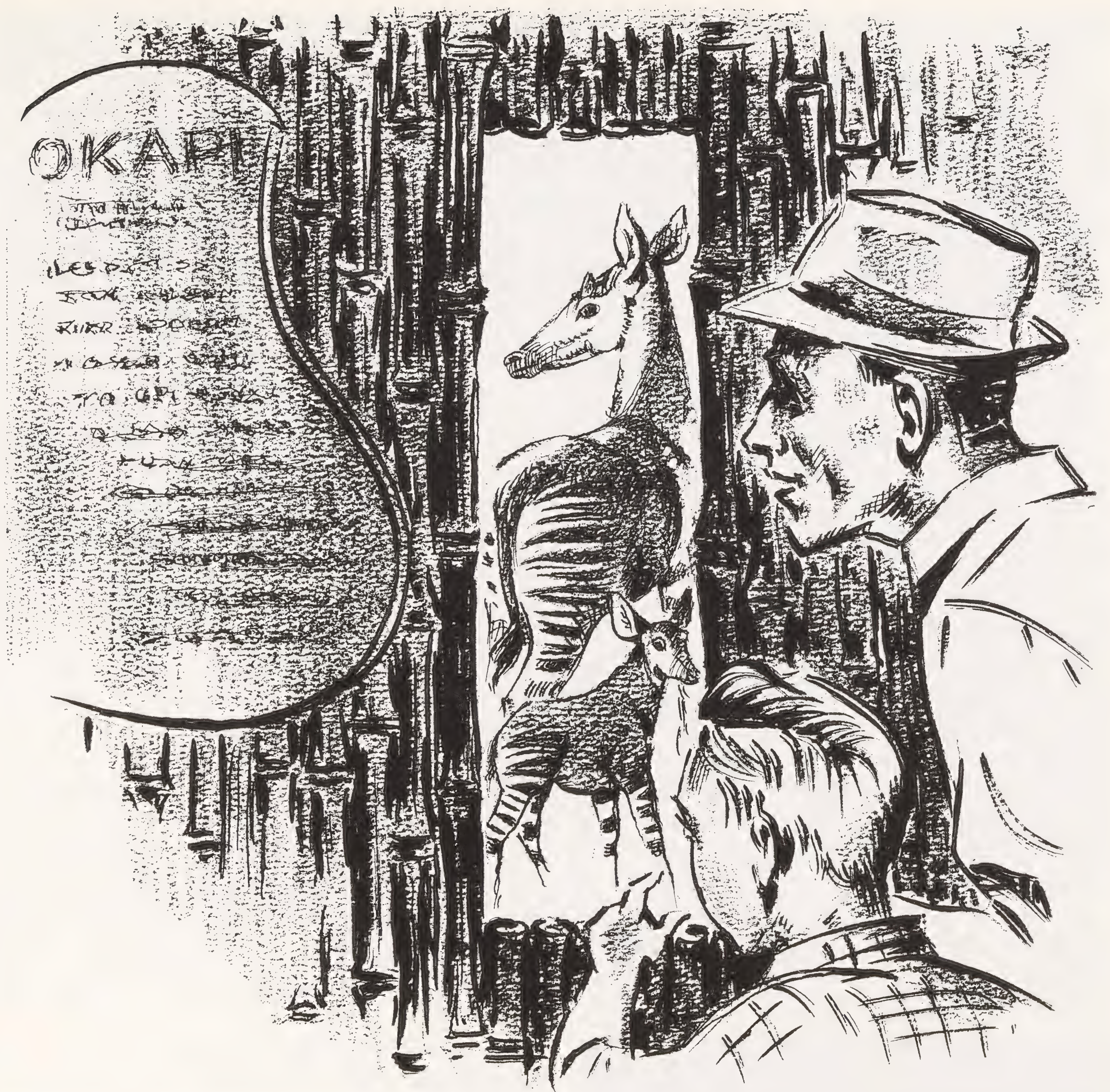
HOLARCTICA AND AFRICA are exciting and in conjunction with the big display buildings they tell much of the story of the earth's fauna, but the story would be far from complete without creatures from the lands south of our own borders. "South America" has been placed, a bit arbitrarily we admit, along the open meadows bordering Cope Lake near the Zoo's Fordham Entrance.

Beyond an entrance flanked by simulated volcanic boulders, the visitor will be confronted by a grassy open green, where guanacos and gray rheas graze in small herds, and Maguarie Storks and screamers, Black-necked Swans and Lapwings roam an Argentine pampas. Uphill, on a barren, boulder-strewn scene, dwell Darwin's Rheas and Vicuna amid scattered clump grasses and tolar. Flamingos, viscachas and tinamou hold the foreground. With one sweeping glance, the viewer's eye may travel from the wildlife of the low pampas to the animals of the distant mountain plateaus. There will be cavies and armadillos in a dry Patagonian scrub, and a patch of forest for tapirs, capybaras and iguanas under the surveillance of vulture-laden trees.

Whatever the scene, whatever the exhibit — and there are many more — we expect to present more information, and do it visually. We are hastening to borrow the best ideas we can get in the world of education and exhibition; museum techniques, even advertising methods (don't worry; no commercials, just more information offered more interestingly — more probing into the living secrets of our world).

But perhaps the most important of our plans is the simplest. Unspectacular and quiet, it is a development which may one day utilize the entire Zoo Forest Reserve east of the Bronx River, the "Wildlife Survival Center."

The "Wildlife Survival Center" will consist almost entirely of breeding enclosures, rearing pens and research areas. It will be devoted to the propagation of endangered species and to research basic to their survival. Here visitors will progress at the convenience of the animals and for the most part observers will be confined in the wildlife-blind type of viewing areas whose peepholes insure that the animals will not be disturbed. Birth announcements, special demonstrations, growth charts and graphically explained research programs will be featured. Perhaps an



admission fee will be charged, to help support the work of the center, and certainly a mood of hospital-like quiet will be maintained.

As a museum acts as a repository for basic "systematic" animal fragments, the Zoo may act, and must act in the future, as the repository for actual living individuals, the population fragments of endangered and extinct-in-the-wild species.

The Wildlife Survival Center which we plan to build, and which we know other zoos hope to build on their own grounds, can be not only a buffer against extinction and a basis for research, but almost as importantly, a strong continuing force in the task of awakening public interest to the plight of vanishing animals.

Most of the steps in our new plans are joint ones. Not only is the City of New York participating with the Society in the financing of every major project, but its Planning Commission, Budget Bureau and Park Department are deeply involved in every aspect of the growth of the programs, which could not be undertaken without their advice and financial support — and which we gratefully acknowledge.

Our plans will not be realized overnight. But we hope to see them substantially realized over the next few years, and then it may just be that the zoo-goer will come closer than ever before to understanding what a wild creature is . . . and enjoying it. He might, quite possibly, learn more about himself, too.

It Steals Stones and Spits Sand —

THE YELLOWHEAD JAWFISH

By CARLETON RAY

Associate Curator, New York Aquarium

SOMEWHERE between the blanquillos (Family Branchiostegidae) and the blennies (Family Blennidae), in some field books of fishes, is the small family of jawfishes (Family Opisthognathidae). Though the relationships between the three families are more superficial than real, it is not hard to see how closer ties would be expected. All three families have common species which home to holes, burrows and crevices and, as befits such habits, are elongate in form and serpentine in movements. Some of them even share a satiny, gentle pastel coloration with long dorsal and anal fins extending much of the body length.

A skin or SCUBA (Self-Contained Underwater Breathing Apparatus) diver often sees a foot-long blanquillo, the Sand Tilefish, *Malacanthus plumieri*, hovering over a burrow while peering inquisitively at him. The fish remains motionless, but for gentle sine-wave motions of the dorsal and anal fins. A soft cream with tints of green and brown and sparkling eyes rimmed with green of electric intensity make this a lovely fish to watch, but if the diver approaches closer than about six feet, the Sand Tilefish wheels and dives head-first down its sand burrow.

Blennies are common from tidepools to deep reefs. One in particular, a little three-inch reef dweller of crevices and cracks in living coral, has much of the same quality of the Sand Tilefish. Its color is softly pastel, chocolate anteriorly, cream posteriorly, and with a flash of red on the thin ventral fins. It is a little "harsher," a bit more "stern" of expression, a little "braver" in defense of its home, I would say, than the Sand Tilefish. There is a definite reluctance on the

part of this blenny to leave its post on a coral head on the approach of the diver.

The Yellowhead Jawfish, *Opisthognathus auri-frons*, carries this sternness of expression and satiny pastel of color to the extreme of these three ecologic congeners. It is a truly beautiful fish despite a hard and argumentative expression. Perhaps it is unscientific to describe animals so anthropomorphically, but it is hard to do otherwise about any fish that "steals" stones to build a home which it defends, spits sand, and is so alertly aware of its surroundings, in the meantime looking just a little mad as well. These are, of course, the characteristics that make the Yellowhead Jawfish such a good exhibit animal — what we might call "peopleness."

The species has a remarkably subtle beauty and is named for the pale yellow of the snout, forehead and jaws. The basic ground color of the rest of the body is a satiny sky blue. More specifically, and beginning with the head, which is often all that is seen by an advancing diver, or peering Aquarium visitor, the mouth of the jawfish is huge and thick-lipped. The maxillary bone which forms the upper "lip" is long and heavy as in the sea basses, but has more of a scowling look than the heavy appearance of the groupers and jewfishes. The snout is snubbed and short and wide. The large eyes are placed high and well forward and have a frowning look with a pupil that is egg-shaped, not round, with the small end forward. Over and under the pupil are electric blue, thickish lines. At just the proper angle, one may see a mirror-like reflection from the retina, as in the big-eyes. The eyes are remarkable in another way — the angle at which



Above — A quick dash at a neighbor fish with jaws wide open is an unmistakable threat in Yellowhead Jawfish language. Right — The underwater home of jawfish off Nassau; one may be seen in the center.

Photo at right is by the author.

they are set in the sockets. This fish is one which spends most of its life vertically, but the eyes are set horizontally, that is parallel to the horizon. The accompanying photographs show this well, as well as the fact that when the jawfish positions itself more horizontally, the eye is capable of some rotation in the socket to keep its essential horizontal orientation. The eye is, then, to a certain extent stationary in orientation as a gyroscope.

I remember very distinctly the first time I ever saw a Yellowhead Jawfish. It was in fifteen feet of water just east of Nassau in the Bahamas in October, 1955. Turtle grass, *Thalassia*, dominated





the flat bottom and the most common invertebrates were sea urchins and the large tropical starfish, *Oreaster*. Coral was sparse but for occasional clumps of Finger Coral, *Porites*. I might not have seen the fishes at all, but for a scanning technique that is sometimes useful in "fish-watching." I lay on the bottom quietly, peering along the tops of the short turtle grass, and quite unexpectedly saw the bobbing head of a little fish peering back. The fish emerged over the grass a bit farther to reveal its lovely pastel colors and a characteristic habit of keeping a vertical posture, tail directly above its small burrow. The jawfish looked at me with inquisitive sternness and when I approached for a better look, sank tail-first into its burrow. This was a half-inch-diameter hole rimmed with small shell and coral fragments and descending vertically into the fine oolitic sand. When I moved back once again, several heads appeared from several holes and I realized that I was facing a colony of a dozen or more Yellowhead Jawfish all in perhaps an area of a hundred square feet of grassy bottom.

Astonishingly large objects can be moved by the jawfish in its capacious mouth; here it drags a shell to the edge of its burrow.

Stones as large as 3/4-inch in length may be carried in the jawfish's mouth to bolster the crumbling sandy rim of its hole.

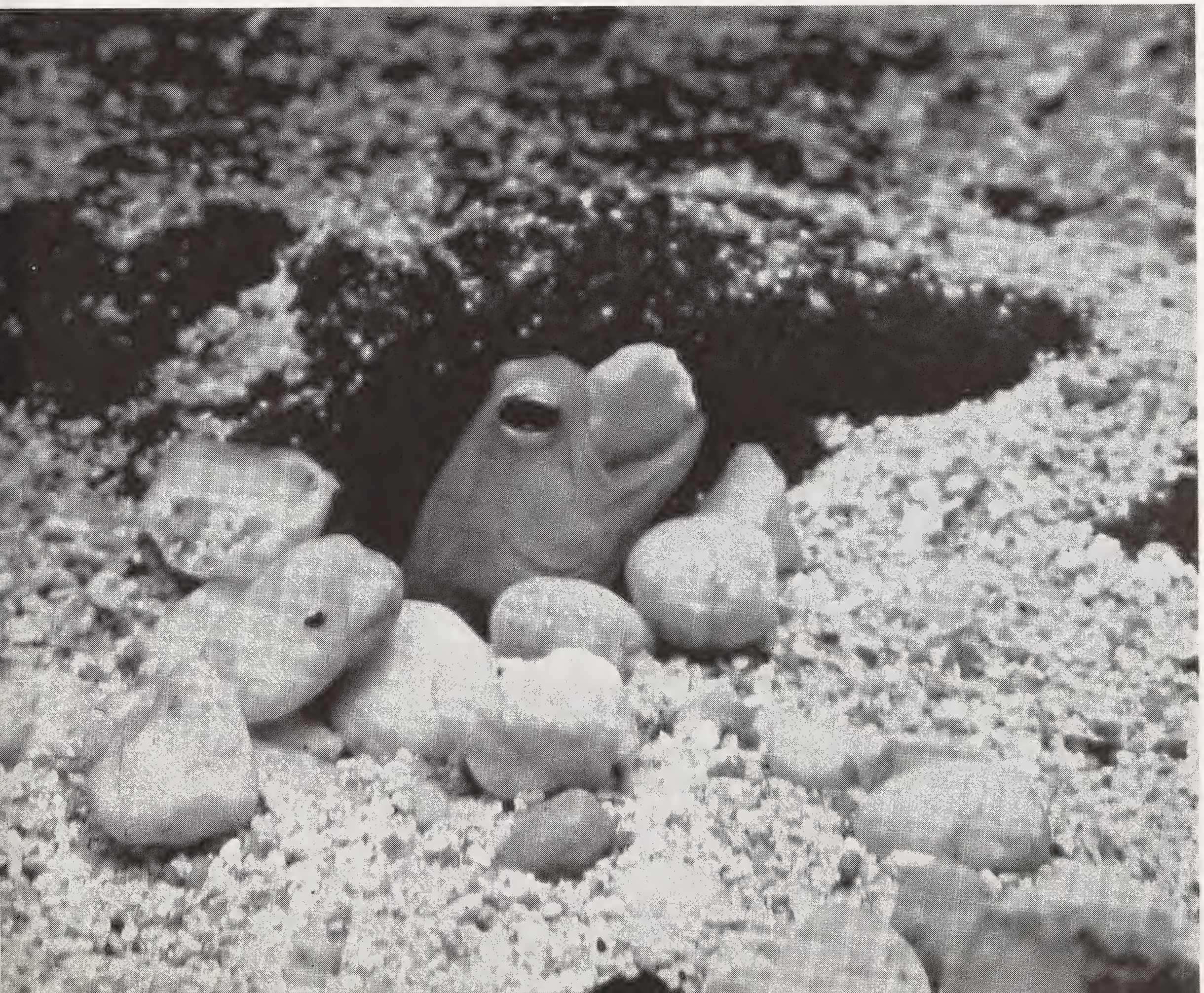
Now, through the expert collecting methods of Henry Feddern of the Institute of Marine Science in Miami, we have a similar colony at the New York Aquarium. So gently were these temperamental fishes handled that they settled in quickly and began to construct their sand and pebble burrows almost immediately. In cases such as these, we fully expect "settling-in" to take a month or more and in order to give the fishes the best chance possible, we place them at first into large, deep, dark tanks liberally scattered with small pieces of tufa rock and coral. Small fishes with relatively high metabolic rates must eat often

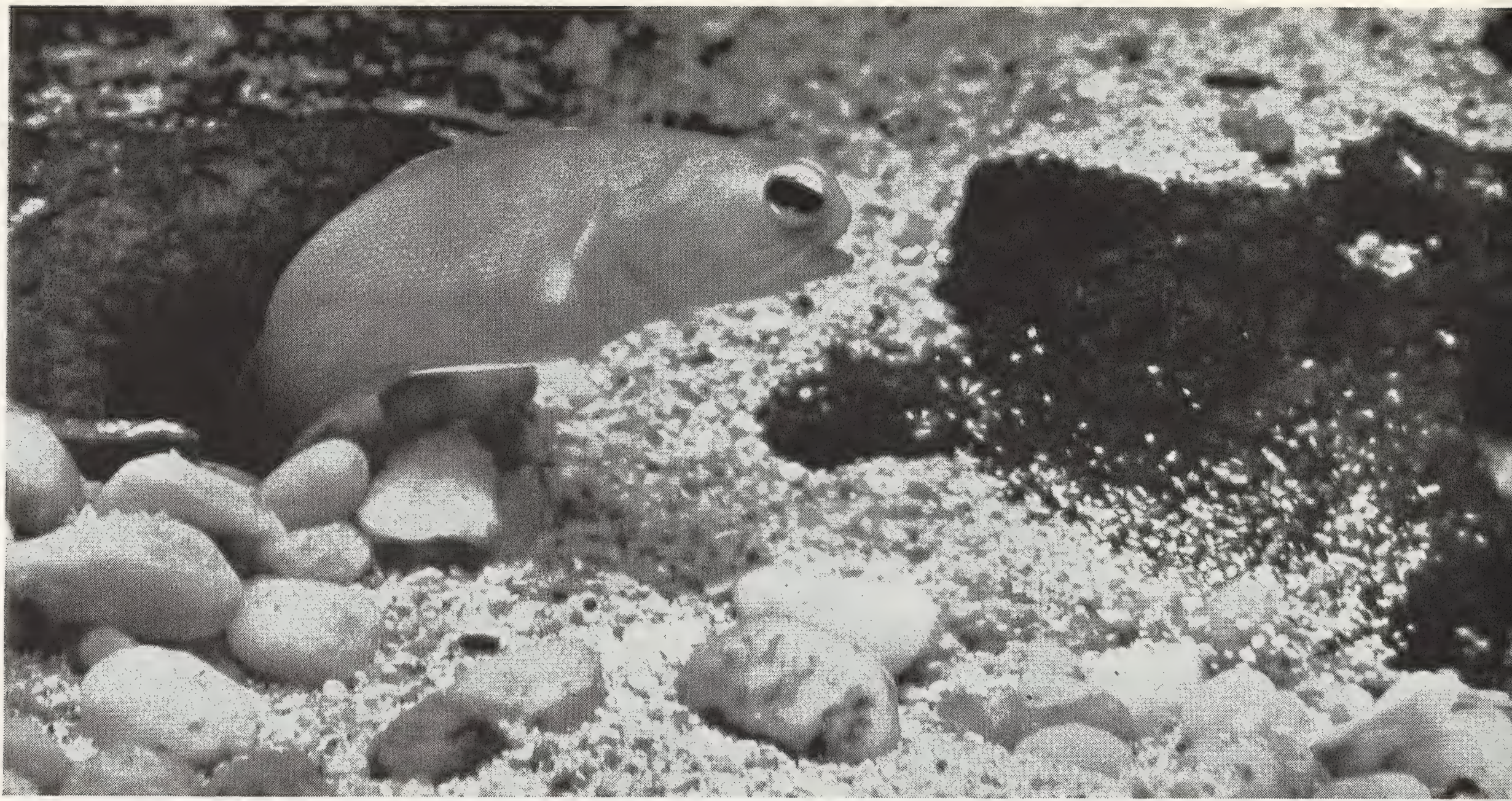
and quickly after their arrival and they will not eat until psychologically "content." If we pressed the jawfish into the relatively disturbed life of exhibition too fast, they might not have eaten until too late.

Once our small colony had adapted to our diet and water conditions, and were pronounced "clean" of parasitic infection, the jawfishes were moved into a 100-gallon tank, the bottom of which was covered with a four-inch thickness of clean Bermuda "pink" sand set with a tufa rock or two and liberally mixed with small coral fragments and roofing pebbles of a quarter-inch to three-quarters-inch in diameter. Almost immediately, burrow construction began in earnest. During the night, mainly, and on Mondays and Tuesdays when the Aquarium is closed in the off-season, the shy little fishes moved what appeared to be most of the sand in their tank, all of it by means of their capacious mouths. Pits appeared in the bottom and next to these were mounds. Pebbles were gathered in little heaps. A couple of the jawfishes chose an easy spot under a rock, easy because of its relative stability in contrast to the shifting sand. All of them used peb-

bles to stabilize the burrows, for without these, cave-ins would have made burrow construction impossible.

At first, jawfishes do not appear to be bothered with a bit of crowding. In a new tank they will freely cluster together under a single rock or share in one another's burrows. Not so for very long. For if their tank is a "healthy" one, they soon become strikingly territorial and will not tolerate burrows being placed too closely together. In one of the Walt Disney True-life Adventure motion pictures, largely about Bahamian reefs, the principal drama was one of territoriality between two Spotfin Jawfish, *Opisthognathus macrognathus*. This fish is not so pretty as the Yellowhead, but it is even more pugnacious when well set up in its burrow. It will nip an intruding tankman's finger, but since the fish is only four inches long, only a portion up to the fingernail is "swallowed" and quickly spit out again. In this movie, two individuals of this species were uncomfortably close together and became avid stealers of each other's building stones, each sneaking surreptitiously off with a piece of the other fellow's home when the latter had its head





Spitting sand is a typical jawfish gesture and it may be performed merely for the purpose of cleaning out its own burrow — or perhaps — aggression toward an encroaching neighbor.

down in its burrow. The drama ended when the psychologically stronger went into the other's burrow and routed him out for good. It appeared as if the fellow with the most rocks won.

As this is written, our Yellowhead Jawfish have just about reached the stage of being settled in and they freely demonstrate for the public. There are four in one tank. The largest, at about three and a half inches, lives in a neat burrow rimmed with small stones, front left, under a mostly buried piece of tufa. Two others share another neat burrow in the open sand (with definite signs that this bliss will not be long-lasting), left front. The fourth, intently watched by the other three, appears to be unsatisfied with present housing arrangements. He is, or was, center rear, about ten inches from each of the other two burrows.

A day or two ago his seemingly good burrow no longer satisfied him. We do not know why. So he began to dig a pit directly in front of the old place, some six inches to the right of the largest fish and ten inches to the left of the other two. He (possibly she) found, like the housewife who decided to remove just one spot from

the wall, that once began, he could not stop. As he dug and the loose sand began to collapse, the pit got deeper and deeper and also wider and wider. More and more pebbles were unearthed. The pit became a full six inches across and four inches deep and a heap of pebbles was neatly stacked near the old house. Every bit of this work was done by mouth. At times stones up to three-quarters of an inch long and, weighing a gram underwater, were carried tediously but vigorously. Larger bits of coral were dragged to the four-inch diameter pebble heap. Every so often he returned to the old burrow, dropping into it tail first and surveying his surroundings but soon returning to his task.

The two smaller burrow-sharers were meekly observational all the while, but the diggings were just a bit too close to the palace-dweller on the left. The house-cleaner would dive into the big pit, come up with a mouthful of sand, swim a bit heavily toward the larger fish, upon which the latter moved to meet this onslaught to its privacy with mouth open in threat. The digger answered by spitting its mouthful of sand onto the larger fish's territory and hastily retreating. But the two on the right were not so meek after all. One came up with a mouthful from its own burrow and spit it in the digger's pit. One fills and the other empties. See what I mean about jawfish? Retribution, no less!

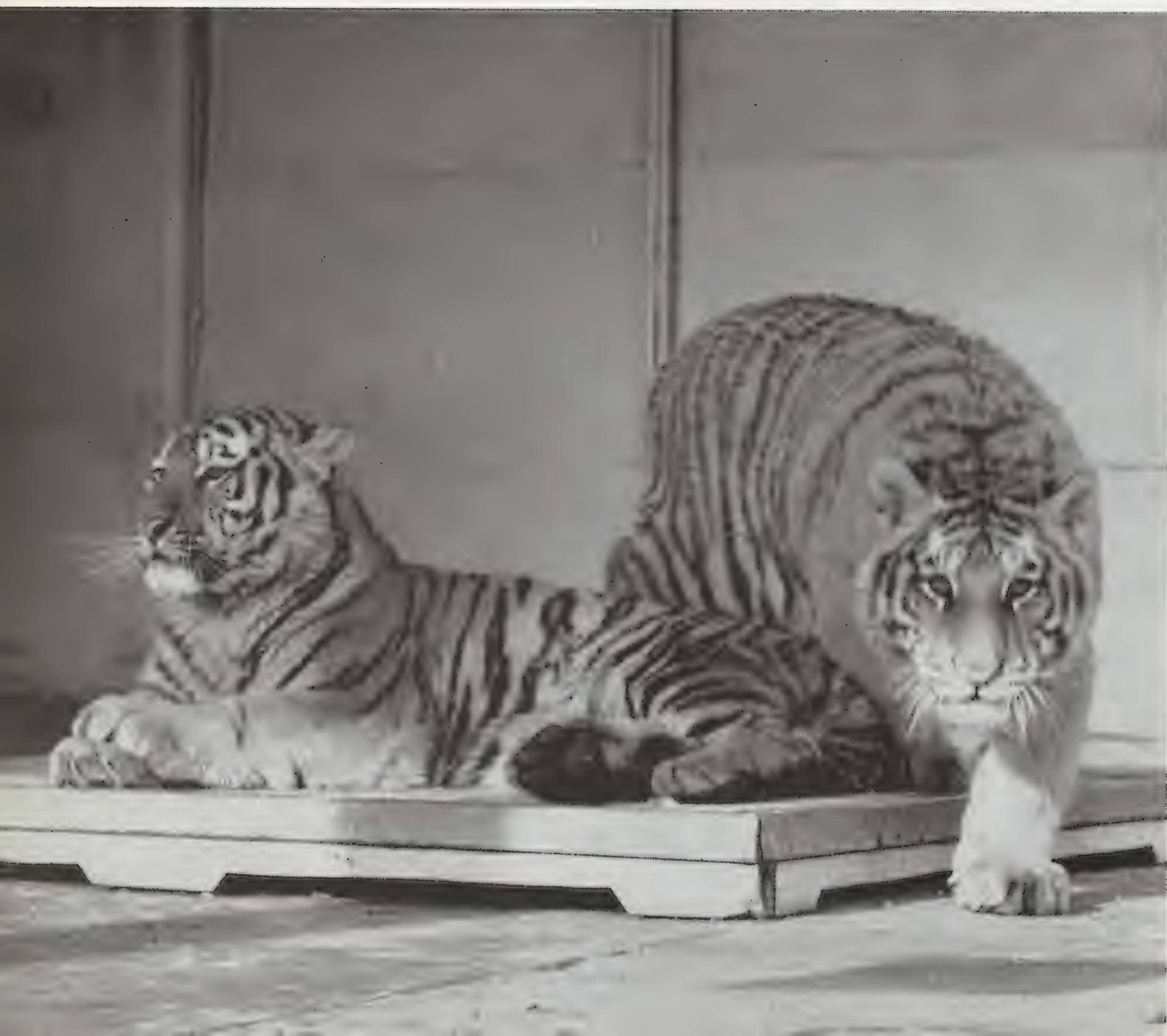
Zoo News In Pictures

Photographs By SAM DUNTON

Staff Photographer



Dingo pups seem to be as inevitable as midwinter cold spells. Six were born on January 4. Dr. Gandal gives vermifuge capsules to three held by Head Keeper Ruf, Keeper Quinn and Assistant Head Keeper Montana.



Among the few animals that have enjoyed every minute of the cold winter were a pair of Siberian Tigers in an out-of-doors compartment of the Lion House. But they have the heavy fur a winter demands.

As a result of a radio contest, our baby White-tailed Gnu now rejoices in the app name of "Gnudles." We hope to build up a herd of this increasingly rare gnu



If young Siamangs are not the most playful animals in the Zoo, they are pretty close to it. These two males are the first we have had since 1930.

Our last Cusimanse — an African Mongoose — died in 1921 and now we have three newly arrived from Liberia. A forest-dwelling animal, it is largely insectivorous. The male has great friendship for Keeper Frank Casella.



The Charge of the Heavy Brigade

By ROYAL LITTLE

*Benefactor Member of the Zoological Society,
furthering the Society's African Wildlife Interests*



WE HAVE JUST SPENT THREE DAYS at Amboseli and it was magnificent. Vegetation was lush, and water plentiful. Besides the unusually fine bird life (including many ostriches) we saw 28 species of mammals including the big five (elephant, lion, buffalo, rhino and leopard); other predators (cheetah,

hyena and jackal); antelope (eland, wildebeest, kongoni, waterbuck, oryx, impala, grant, gerenuk, bushbuck, tommy, dikdik); and others (giraffe, zebra, warthog, bat-eared fox, baboon, vervet monkey, African hare, mongoose and ground squirrel).

We were fortunate to see many unusual sights:

a pride of eight lions and two cubs; three cheetahs chasing jackals; four rhinos together; fourteen gerenuks in one herd; four baby bat-eared foxes playing in the sun; a leopard that had been badly mauled by a lion; and over 100 elephants in one group.

Our most unusual experience occurred while following a large herd of elephants with cameras at the ready. Soon they split into three bunches and we followed about thirty of them that had two young calves. They were travelling pretty fast through rough bush, so we had trouble keeping up with them. When they broke out into

Cameras at the ready, the party followed a herd with two young calves. It was a risk, even 200 yards away.

A "Charge of the Heavy Brigade" began every time the car stopped, but fortunately was not continued.

the open we cruised alongside two hundred yards to their left, hoping to get good movies of the single file parade. Two large bulls bringing up the rear, however, had a different idea. Every time we stopped to take pictures, they would leave the line and come charging toward us, trumpeting through extended trunks, with ears flapping. As soon as we gave ground they would rejoin the procession, but on one occasion, as if by pre-arranged signal, all thirty animals wheeled in unison 90° to their left and came screaming toward us. We sat in the car fascinated by "The Charge of the Heavy Brigade." Fortunately they stopped and resumed their previous course after stepping off 50 yards in record time.

Again we drove along at a respectful distance, parallel to their line of march. Suddenly three huge bulls broke ranks and headed for us. After charging about 50 yards they formed a tight circle and began rotating around each other. They were trumpeting, flailing their trunks in all directions and urinating copiously in their excitement. Simultaneously two cows, each with a



small calf, left the rest of the herd and rushed back to join the bulls. The five animals then formed a perfect protective circle around the young ones and it was only then that we realized why we had received such a warm reception from the herd. Finally, the biggest bull, seeing that we were still in evidence, took off after us in earnest. This time he chased us a good 300 yards with trunk fully extended, head high, tusks aimed at us and trumpeting furiously. At one point it seemed as though I could have reached out of the car and touched the tip of his trunk, but Donald Ker, who was driving, claimed later that the mammoth was at least 25 yards behind us. Moral of this story: don't fool around a herd of elephant with small fry in their midst!

When Jim Simon and I visited Amboseli on our photographic mission for the Zoological Society in 1961, we were appalled by what we saw. As a result of prolonged drought thousands of Masai cattle swarmed over the Game Reserve, competing with the wildlife for water at the Swamp. The whole area was rapidly becoming a dustbowl and it was obvious that mixed grazing could not be successful. In the long run the wild animals might have to go. It appeared as though Amboseli as a game sanctuary was about to die. That year the Masai were losing cattle by the thousands and since the Amboseli Game Reserve was on their land, they felt they should have access to its grazing and water resources during droughts. As a result a most difficult conflict of interest developed. At that time Amboseli Game Reserve was under the management of Royal Kenya National Parks, although it was not actually in the park system.

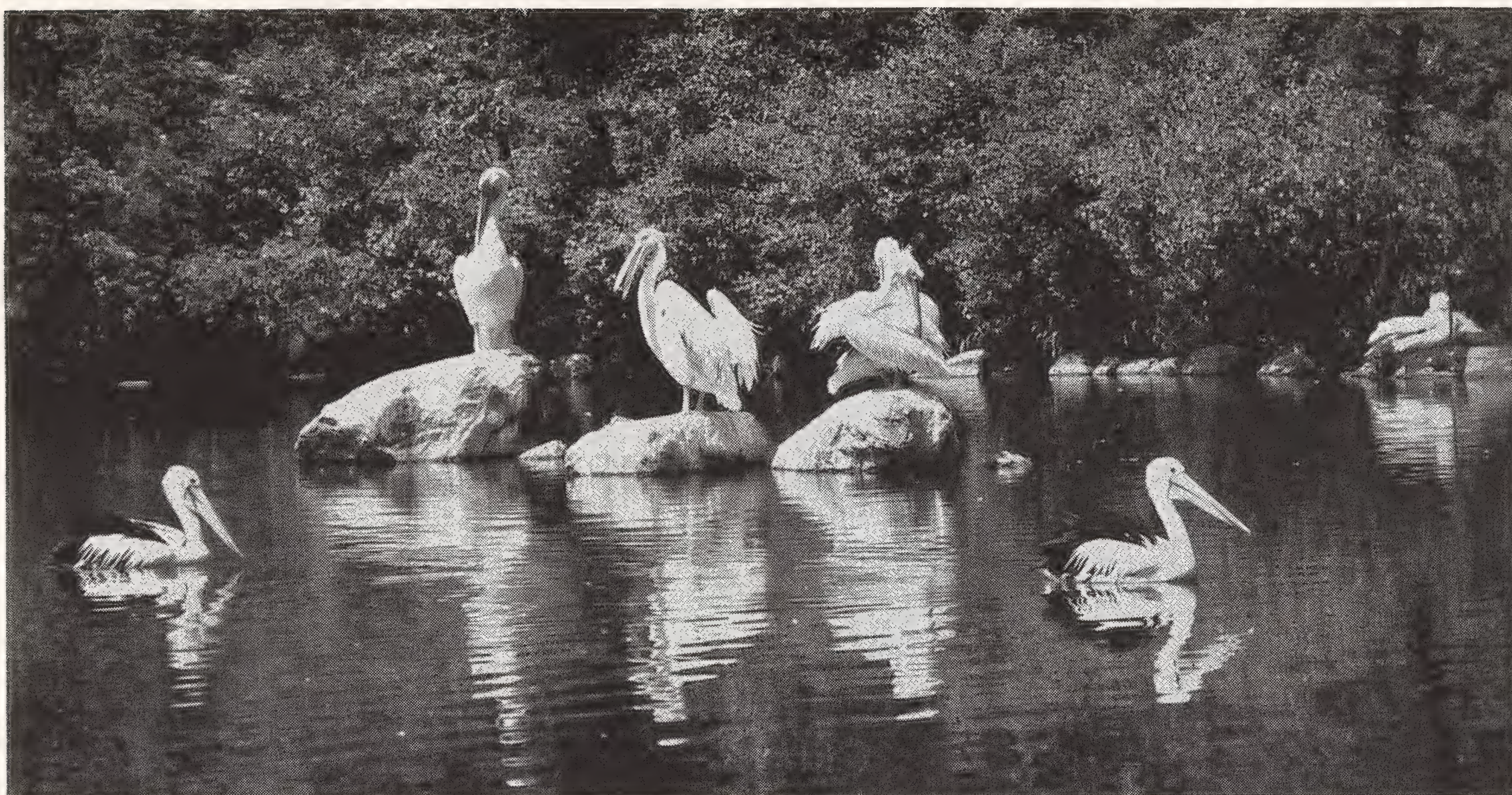
Col. Mervyn Cowie, the Director of National Parks, and his Trustees had early recognised the problems which might arise at Amboseli should there be a severe drought, as well as the daily problems which were inevitable with the mixed grazing of domestic herds and wild animals. As a step towards segregation some sixteen boreholes were drilled around the periphery of the area set aside for game, so that the Masai could water their cattle at these wells without invading the Reserve itself. The New York Zoological Society participated financially in a small way in this project. In early 1961, however, conditions became so acute that the Masai refused to limit

their activities to these new facilities and overran the entire area, doing immense damage to the habitat. Col. Cowie and his staff were powerless to enforce their segregation regulations since the Masai reported to a district commissioner of another Governmental agency, the primary responsibility of which was to protect the rights of the Masai.

Since 1961 a plan has been adopted by the Kenya Government which may provide the solution for the Amboseli problem. The National Park system no longer manages the area. The responsibility for the preservation of Amboseli's wildlife has been turned over to the Masai themselves. Formerly they obtained small income from this operation. Now they receive entrance fees and certain ground rentals so that they have a greater financial stake in the future of this Masai Game Reserve and its wildlife.

In 1962 Amboseli had over 6,500 visitors and its limited tourist accommodations are booked far ahead. The Kenya Government has recently authorized the expenditure of £25,000 to build an attractive lodge and restaurant at Ol Tukai, similar to the new Kilaguni Lodge in the Tsavo National Park.

Management is administered by an African District Council whose regulations are law so far as the Masai chiefs and cattle owners are concerned. With the dual responsibility of the past eliminated, the chain of command is now direct and positive. I am delighted to report that in early January of this year we saw no Masai cattle inside the circle of peripheral waterholes so wisely planned by Colonel Cowie. It must be noted, however, that Amboseli is in perfect condition as a result of recent heavy rains. Everything is green and water is plentiful so there is no pressure for the Masai to violate the regulations and invade the area reserved for game. The world will not know whether the present plan of operation is going to be successful for the future until another severe drought is experienced. If the African Council can prevent the Masai from driving their herds beyond the encircling boreholes in another year like 1961, they will have accomplished something which the Kenya National Parks organization were never given the complete authority to do — save Amboseli's fantastic wildlife heritage!



Here Come the Pelicans!

By WILLIAM BRIDGES

Curator of Publications

SOME MORNING in May a truck will pull up alongside Cope Lake on the northern boundary of the Zoological Park and half a dozen keepers will jump out and start unloading pelicans. Since November they have been in winter quarters in the converted greenhouse of the Farm-in-the-Zoo, where only the skimpiest facilities for bathing can be provided, and the return to abundant water is a Red Letter Day — and not only for the pelicans. Visitors look forward to their annual return and gather along the shore for the 11 o'clock feeding. So do the birds; they cannot read the posted signs telling the feeding hour at Cope Lake but they know it exactly. Every pelican is waiting at the feeding station at 11 o'clock for the arrival of the keeper and his bucket of fish.

Pelicans have an old and honorable place in the Bronx Zoo's history. Our first ones arrived even before the Zoo was open to the public. In February of 1899 Dr. William T. Hornaday, the first Director, took a vacation trip to Florida and, with the animal needs of his young Zoo always

in mind, made arrangements for a local collector to capture waterfowl along the St. Johns River. The collector reached New York in mid-summer with 200 birds, among them 14 Brown Pelicans. This was considerably more pelicans than Dr. Hornaday felt that we needed, but the surplus came in handy. Three were traded to the Prospect Park Zoo in Brooklyn for (of all things!) three Elk. One was presented to the Buffalo Zoo. One flew away and was shot in Pelham Bay. In following years more Brown Pelicans arrived and two were even exchanged with the Hagenbecks in Germany for our first Blue Mountain Sheep — a favorable trade we would dearly love to make again today.

Since those early days the Bronx Zoo's collection of pelicans has waxed and waned, but there have always been pelicans. There are six species in the world (with numerous subspecies), and we have representatives of all six: the Eastern Brown (*Pelecanus occidentalis carolinensis*), the American White (*Pelecanus erythrorhynchos*), the European White (*Pelecanus onocrotalus*),

the Dalmatian (*Pelecanus roseus crispus*), the Australian Black-backed (*Pelecanus c. conspicillatus*) and the Red-backed (*Pelecanus rufescens*).

Most familiar to Easterners are the Brown Pelicans of the South Atlantic and Gulf coasts, while Westerners are likely to know the California Brown (a subspecies) or the White Pelican that breeds in the lake regions of the northwestern interior. The White Pelican is one of the largest birds in North America — its wingspread certainly approaches 10 feet — and it is unmistakable wherever it goes. Oddly enough, it has gone to a good many places where it would not normally be expected; there are records of its casual appearance in nearly every state. Probably the first record in New York State was in 1788 when *The New York Journal and Weekly Register* reported:

"A few days ago, a curious and uncommon BIRD was killed at Saratoga and sent, as a rarity, to Albany. The distance from the tip of one wing to the other when both were extended, was nine feet and two inches; the mouth was large enough to contain, with ease, the head of a boy of ten years of age, and the throat so capacious as to admit the foot or leg of a man boot and all." In Albany a naturalist identified the wanderer as a White Pelican.

It is easy to imagine that "What on earth is it?" curiosity of Saratogans 176 years ago, but their interest has been matched on many other occasions when White or Brown Pelicans have been seen far away from their usual haunts. In the spring of 1948 there were stories in the St. Louis newspapers about three "great birds" seen flying over the city; the next day three Brown Pelicans were positively identified south of Quincy, Ill. A few years earlier a White Pelican was reported hanging around the Orland Wildlife Refuge in Cook Co., Ill., and fifty bird watchers turned out on a Sunday to gaze at it through their binoculars. Actually, White Pelicans normally migrate through the area.

In 1939 five Brown Pelicans were sighted over Fairfield Beach, Conn., flying northeast. There are similar casual records from many parts of the United States and all the provinces of Canada.

No stray pelican has ever been captured in the New York area and contributed to the Zoo — the usual destination of exotic strays that get into difficulties. Pelicans are, by and large, self-sufficient birds and well able to take care of themselves as long as there is water and fish.

Not only were Brown Pelicans among the first birds to come to the New Zoological Park in

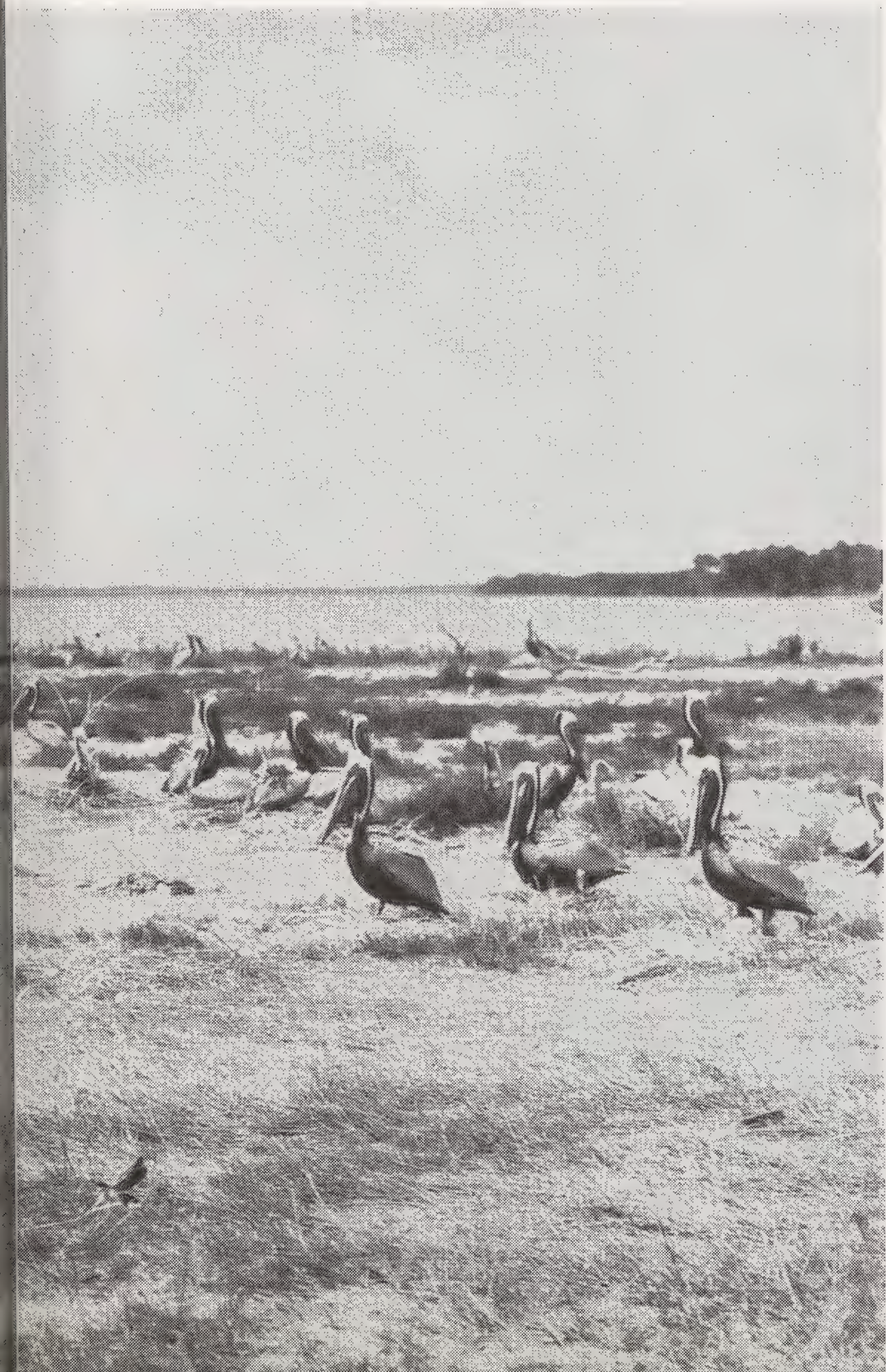


1899, but one of the first major articles in the Zoological Society's magazine in those early days was about them. In 1904 Dr. William Beebe, then Curator of Birds, made a photographic visit to Pelican Island in the Indian River of Florida's east coast and took dozens of photographs of that ancient colony and refuge. Pelican Island still exists, under Federal protection.

A century ago the pelicans on Pelican Island built their nests in trees (as they still do in some parts of Florida's west coast) but the trees have disappeared and now they nest on the ground. A pelican's nest may be made of anything — or almost nothing. They may use sticks, leaves, grass, straw, or anything else available; lacking materials, the nest may be a mere shallow depression in the sand. There seems to be an ad-

The Bronx Zoo hatched a Brown Pelican chick in 1913. It is a rare event simply because zoos seldom keep groups of pelicans.

Dr. William Beebe visited Pelican Island in the Indian River of Florida early in the century and photographed nesting birds.



vantage in building a mound, however, for high tides sometimes wash away the eggs from depression nests. Naturalists have noted the habit of pelicans of scraping up fine material around the edge of the nest with their beaks, so that lines like radiating spokes are scraped in the sand or soil by the sitting bird.

Usually there are two eggs, with a range of one to four. Incubation is approximately four weeks, and the newly hatched pelican chicks have been described as "far from attractive, looking more like shapeless masses of half-dried meat than young birds."

Because groups of pelicans are seldom kept, breedings in captivity are rare. It has occurred in our own collection only once, in 1913, when two pairs of Brown Pelicans built nests in the great Flying Cage; one pair hatched its single egg. The young bird was reared successfully.

Parent birds returning to the nest recognize their own young, even though there may be a crowd of apparently identical youngsters wandering together and all clamoring for food. At first the chicks are fed on predigested food that is regurgitated and allowed to flow to the tip of the bill; later the youngster learns to plunge his head into the parent's open bill and seize larger pieces of fish.

Many years ago Dr. Frank M. Chapman described the feeding process:

"The parent does not, of course, always have to fight its way through a mob to feed its offspring. Often only a bird or two is to be driven off and on such occasions the rightful young assist, the method of attack employed by both being thrusts of the bill from which no harm appears to follow. The actions of the rejected young bird are remarkable. With an only-son air he prances confidently up to the food-bearing adult and without so much as by your leave attempts to insert his bill. When, however, he receives a blow where he expected a fish, his demonstrations of disappointment are uncontrolled. He acts like a bird demented, swinging his head from side to side, biting one wing and whirling around to bite the other in the most ludicrous fashion."

This curious behavior was reported also by Dr. Chapman for young birds which have been allowed to feed from the parent's pouch — and in even more exaggerated form.

The Brown Pelican's appetite for fish is enormous but fortunately does not conflict with human interests, since it feeds principally on menhaden, mullet and similar species not prized by game fishermen. Unlike the White Pelican, which fishes by cruising through a shoal of small fishes and scooping them up in its pouch, the Brown Pelican is a diver. Flying at heights of 10 to 50 feet, it spots a fish, folds its wings and usually plunges downwind into the water, at considerable speed and force. Making a turn underwater, it surfaces facing upwind, which assists it in getting off the water with its prey.

Sometimes, of course, it does not get off with its prey; gulls have learned to follow pelicans and seize the fish protruding from their mouths. By most accounts, pelicans accept this as a part of the game and show no resentment. Gulls even perch on a pelican's beak to get at the fish.

On occasions a pelican bites off more than, figuratively, he can chew. There is an account of a Brown Pelican seen in distress in Pensacola Bay. Taken to shore, it was found to have a 15-inch live Sheepshead caught in its pouch. Presumably the pelican dived, struck the large fish head on, and subsequently died of suffocation. It is likely that this sort of thing happens many times, and that some pelicans themselves fall prey to large fish while they are underwater.

It is a good guess that something like that happened to a certain Brown Pelican off St. Kitts on an April morning 42 years ago. Dr. John Tee-Van tells the story; at that time he was attached to the Zoological Society's Department of Tropical Research. On that April morning he was sitting on the beach and idly watching a pelican cruising about 200 feet offshore in a slow flap-flap-glide flight. Just as it came opposite Dr. Tee-Van the bird plunged toward the glassy surface of the water in a hard dive.

Seconds passed, half a minute, a minute. Dr. Tee-Van sat there for another half hour. But the pelican never came up again.

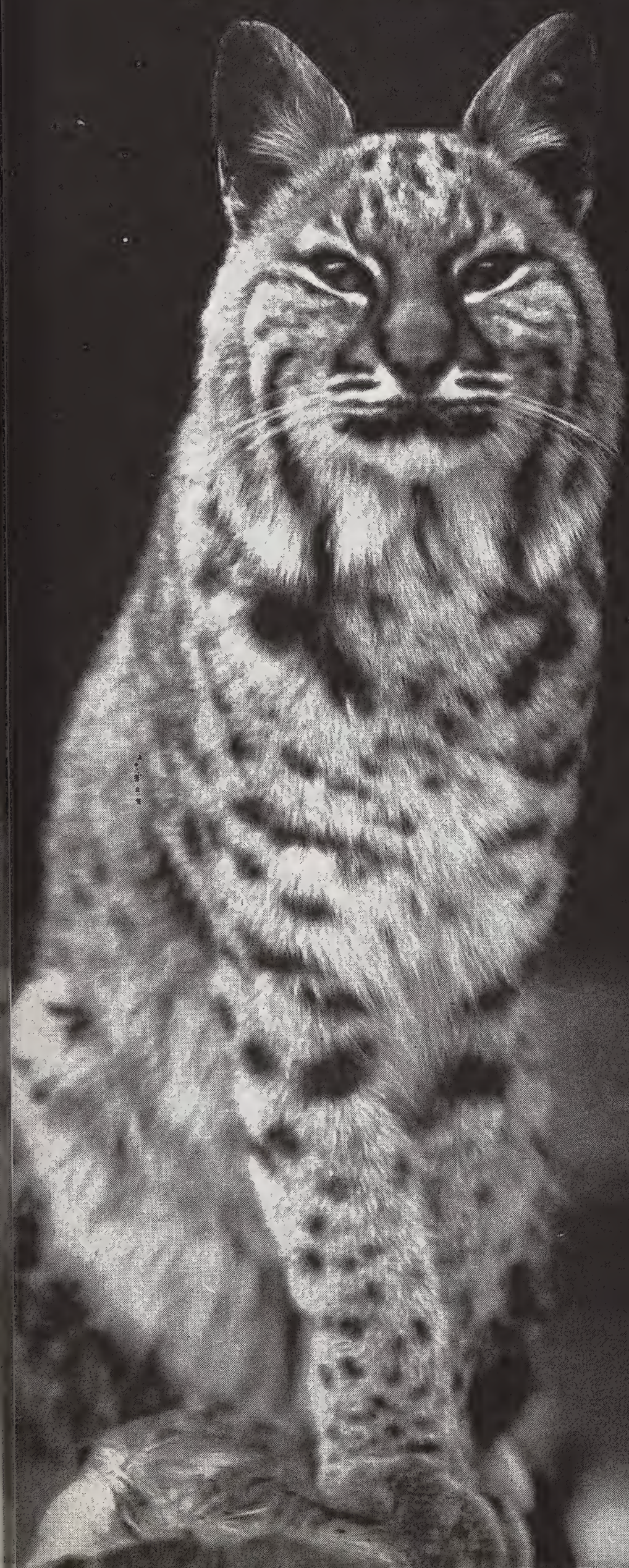
No such misfortunes attend the pelicans in the Zoo, however. Their 11 o'clock feeding consists of slices of butterfish that can be swallowed without the slightest difficulty, although if a slice is particularly long it may be tossed in the air by the bird and snapped into the pouch when it is headed downward in an easy swallowing position.

It is an easy life; the winters are passed in a greenhouse heated to Florida temperatures, the summers on a placid lake where food miraculously appears at 11 o'clock every morning in the week. It is no wonder, then, that for a long time one of the elders of the Bronx Zoo was a pelican. "Old Jenny," a European White Pelican, came to us on April 20, 1904, and survived until November 10, 1944 — a longevity of 40 years, 6 months and 21 days. Her record was exceeded only by two pelicans in the Rotterdam Zoo who lived 48 years and 9 months, and 41 years and 5 months, respectively.

We are still doing well with our pelicans. Our present American White came on March 19, 1938; the Australian Black-backed on May 25, 1939; the European White on May 22, 1946; the Red-backed on August 7, 1951; and the Dalmatian on October 15, 1953.

BOBCATS STILL ROAM WILD & FREE

By
LARRY PRINGLE



IN THE RAMAPO MOUNTAINS, just 30 miles from New York City, Bobcats tread softly on autumn's lately fallen leaves. Others stalk among cacti in California's arid deserts and patrol Florida's wooded swamps. The Bobcat is North America's most common wild cat — and one of our least-known mammals.

These wily felines have been captured in every state of the continental United States. Their range extends into Canada and Mexico. Yet most people are surprised to learn that Bobcats are not a rarity, and may even prowl in a "civilized" countryside. The cats' anonymity is due to their secretive habits; they hunt at night, in dense brush, secluded swamps and hilly forests. They may lurk close to suburbia, but are seldom seen.

Bobcats were plentiful when pioneers settled this country, but the early history of their relations with white men is hazy. Mountain lions, Lynx and Bobcats all lived in the Northeast, and colonial naturalists seldom made distinctions between them in their writings. The names "wildcat", "Great Grey Lynx", and "Siberian Lynx" seemed to apply to either Lynx or Bobcat; even the Fisher was considered a "black cat." In 1637, Thomas Morton in his "New English Canaan" had yet another name for Bobcats, as he wrote, "The Luseran, or Luseret, is a beast like a Catt, but so bigg as a great hound: with a tayle shorter than a Catt. His clawes are like a Catts."

Today Bobcats are still called "wildcats", or "bay lynx" in some areas. They are *Lynx rufus* to zoologists. And Morton's original description wasn't bad. Bobcats are hound-size: about a yard long and two feet high at the shoulder. Their taye — oops, tail — is four to seven inches long, with a black and white tip. Pelt color varies from buff to reddish-brown (desert cats are dullest). The short coat is streaked with black; the white belly usually black-spotted.

The first Bobcat I saw was a russet color. As my car rounded a curve on a Massachusetts woods road, I spied a large, reddish animal running ahead. Speeding after it, I was soon close



Bobcat tracks in the snow. As can be seen even in a photograph, they show no marks of the toenails, for cats sheathe their retractile claws in walking. Dog tracks always show the nails.

Photograph by the author.

enough to see the long-legged body, short tail and peculiar "rocking-horse" gait of a loping Bobcat. Soon the cat was just 30 feet ahead; the car's speed was 40 miles per hour. Then the cat ducked into roadside brush. I left with new respect for *Lynx rufus* — a 25 to 30 miles per hour speedster.

That cat was good-sized, probably weighing 15 to 20 pounds. Males average near 20 pounds; females, 14.5 pounds, according to a Vermont study of 376 specimens. Exceptionally large "Toms" weigh over 40 pounds, and inevitably there are claims and arguments about the largest Bobcat ever killed. The title goes to a 69-pound male taken in Colorado, but Ohio, New Mexico, Nevada and New Hampshire have all yielded cats weighing over 55 pounds. New York's

record cat, almost 47 pounds, was killed less than a year ago in the Adirondacks.

Big or little, Bobcats are fascinating creatures. Although they are often pictured as snarling menaces, their actions sometimes resemble those of docile household tabbies. Bob-kittens are cute, and grow into purring, mewling, curious adults. Like domestic cats, these wildcats continually lick themselves clean, avoid getting wet feet and toy with small prey. There are even a few cases of cross-breeding between house cats and Bobcats. On the other hand, some domestic cats become meals of their wild relatives, who must hunt to live.

Bobcats are well-equipped for their predatory role. Their razor-sharp retractile claws and needle-teeth are matched with traditional feline stealth and patience. They have exceptional eyesight, keen ears and powerful, springlike legs capable of 10-foot leaps. A cat prowls three to seven miles in a single night; a home range of 15 to 20 square miles is common.

To learn more about Bobcat hunting habits, biologists have actually trailed these animals in winter snow. I followed a Massachusetts cat for six miles one day in February, 1959. Tracking conditions were perfect; each print was clear as the cat traveled on powdered crust. He sneaked through pine plantations, stalking and chasing snowshoe hare and rabbits without success. Porcupine dens in ledges and hollow trees were explored. Even a long-deserted Beaver lodge was checked.

At one point the cat's tracks suddenly changed. Each print lay close to the next, as he inched forward in a stalk for 50 feet. He crouched low beside a hemlock, then leaped. Four bounds carried him 30 feet to a deer bed. But the deer escaped — warned by the cat's weight crashing through the crust during those last leaps. After a few spiteful bounds in pursuit, the Bobcat resumed his travels.

Biologists are particularly curious about wild-cat food habits, since these animals are the only large predator in many parts of the United States. Studies across the country show that Bobcat diet varies with locality, season and time. Like all predators, they take what food they can get. Thus they have been recorded as having eaten such unlikely items as Great Blue Herons, owls,

crayfish and bats. But their normal prey are rabbits and hares, mice, deer, squirrels, grouse and porcupines.

In New Hampshire, a disease once decimated the hare population, and Bobcat numbers also dropped, indicating their dependence on the snowshoes. A Michigan biologist analyzed 300 cat droppings and found remains of hare in 90 per cent.

Cottontails are a staple food in more southern localities. A Massachusetts hunter reports an instance where two cats killed five cottontails and a grouse in one night. In 1961, I found where a cat had killed a grouse in the Adirondacks. He stalked the ground-roosting bird from three angles, finally creeping close enough to pounce on it with one leap. After eating part, he carried it along on his travels. "Packing a lunch" like that is not unusual; New England hunters chased a cat two hours before it "treed," then found it had carried a rabbit during the entire chase. Bobcats often move their food around, and scratch debris over it in hopes of returning to dine.

Native rodents usually make up at least a quarter of wildcat diets. The species of rodent depends on locality. Thus red-backed and deer mice are common prey in the Northeast, cotton rats in the South and prairie dogs are preyed upon in the West.

Throughout their range, Bobcats feed on deer. Venison constitutes 20 to 40 per cent. of cat stomach contents in most food studies. Some of this is carrion, left by hunters, but there are many eye-witness accounts by outdoorsmen of Bobcat deer-kills. As for the method, a mid-West naturalist commented: "Once in a while a heavy

cat will kill a full grown deer and it is done quickly and efficiently by biting the throat. Rarely does a deer travel over 30 feet after the initial attack but sometimes we find where the deer has been successful in brushing off his assailant by making use of a convenient overhanging limb."

Deer are usually attacked while lying down and the Bobcat attempts to sever the windpipe. Even fairly small cats are capable of such acts; their sharp teeth offset the handicap of slight size. One such cat killed three deer in a single night — all within a half mile's travel. This is exceptional, however. A Michigan biologist found that at least a third of cat-killed deer were in poor health. Actually, in many areas deer populations are in need of such predation to lessen the demand on over-browsed food supplies.

Another trait in the Bobcat's favor is its taste for porcupines. Contents of a dozen cat stomachs from New Hampshire were almost all porcupine remains. Where they are plentiful, these destructive rodents are a regular item on wildcat menus. Rarely does a nimble cat step into a fatal faceful of quills.

With their exceptional eyesight, strength and stealth, it would seem that Bobcats have an easy life, free from hunger and harassment. But this is not so. They sometimes find themselves the hunted, chased by pumas and coyotes. Even deer sometimes turn successfully against wildcats, leaving them bruised and battered. Winters of deep, loose snow hamper their hunting, and hunters, trappers and starvation take a heavy toll. Fleas, ticks and internal parasites add to their woes.

Man is their worst enemy. Bobcats' taste for

Bob-kittens are often born in rocky dens such as this one. Porcupines, a common prey of the Bobcat, also live in this kind of wild, broken habitat.

Photograph by the author.



game, plus an occasional sheep or chicken, insures the animosity of hunters and farmers. And, although they have little fur value, they represent a challenge to trappers. Many states offer a bounty of \$10 or more. While these rewards are not effective in reducing wildcat numbers, they are useful as indicators of Bobcat population trends. Right now, despite their enemies, Bobcats are increasing in several states — Virginia and New Hampshire, for example.

If food and cover are plentiful, wildcat reproduction usually balances or exceeds the toll of enemies. Bobcats breed from January to September, with most conceptions occurring in March and April. An October embryo litter has been found. Evidence points to Bobcat females being polyestrous; if not bred in late winter, they are receptive again during spring and summer.

Little is known of Bobcat breeding habits and estimates of their gestation period vary from 50 to 70 days. The female selects a den — often under ledges or in a hollow log — and there two to four kittens are born. They weigh six to twelve ounces at birth, and usually rely on mother's milk for two months. Biologists disagree on the male's role during this period; some claim he helps bring food, others say he is chased away by the female.

The young grow quickly, often weighing 10 pounds by autumn. They stay with the female during the fall, hunt cooperatively, then part with the advent of the breeding season. Meanwhile, the mother is an excellent guardian, fighting off enemies and moving the kits if danger threatens. A Texas trapper caught two half-grown kittens and discovered from tell-tale tracks and bits of fur that the mother had been bringing food to her imprisoned offspring.

Once away from mother, a young Bobcat has a short life expectancy. Although a specimen in a small private zoo in New Jersey lived 25 years, a 10-year-old would be quite elderly in the wild. Trappers and hunters keep most cats from reaching that age.

Experienced trappers catch Bobcats easily, for their curiosity and hunger often overcome wariness. A Utah biologist caught, tagged and released a wildcat, then recaptured the animal in the same trap two weeks later. Bobcats follow a regular route in covering their territory, so even

if a cat's home range is 40 square miles, a trapper with a good "set" on a known Bobcat trail will have his patience rewarded.

Since a Bobcat's eyesight is superior to its sense of smell, trappers use visual lures, such as a suspended, free-swinging chicken wing. Once attracted to a spot, fresh bait or oil of catnip usually entices the cat into a trap.

Bobcats are at their cunning best when pursued by hounds. Unless deep snow hampers them, they lead their trailers on a tortuous tour of all the rough country they know. Bobcat hunters I have known are an elite group; some of them spend sizeable sums to get a pack of good wildcat dogs. During fall and winter they leave home and family every weekend and take to the woods. When a fresh cat track is found, they may spend days climbing mountain ledges or pushing through thick swamps — on snowshoes — in hopes of a glimpse of the fleeing cat. Often the cat hides in an inaccessible den, and the hunters return empty-handed.

Bobcat hunters are seldom discouraged by these failures; they are content with a few cats each winter. They recognize Bobcats as a source of great sport, and go to great lengths to maintain that sport. They jealously guard their "territory," and keep close watch on the cat population, always leaving some breeding stock. Some hunters even let cats escape after hounds "tree" them. On Michigan's Lower Peninsula, Bobcats have the status of game animals, and are protected for nine months of the year.

As this country matures in its conservation thinking, other predators such as the Bobcat are given credit for game, esthetic or ecological value. The enactment of "model bird laws" in many states shows that people are beginning to understand that raptors like Great Horned Owls have a vital role in animal communities. Many conservationists welcome the coyote to the Northeast, as a natural check on over-abundant deer. The concept that predator control is a panacea for low game numbers was proved false long ago.

In time, perhaps more states will recognize the Bobcat as a game animal, not "vermin," and grant it partial protection. However that may be, these cunning cats will continue to pad silently through the nation's mountains, deserts and swamps — often closer than you think.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM
AND THE DEPARTMENT OF TROPICAL RESEARCH

Dr. Osborn Addresses Conference of the Sierra Club

Dr. Fairfield Osborn attended the eighth biennial wilderness conference of the Sierra Club in San Francisco on March 8 and gave the banquet address. He pointed out that "Today in this country, as well as in most others throughout the world, the future of wilderness, if measured in the time-span of the next forty or fifty years, is precarious in the extreme." He urged the sponsoring Sierra Club to help awaken general consciousness to the dangers of the population explosion, to continue in legislative halls the battle for preservation of wilderness areas, to encourage individual owners of property to donate suitable lands and to sponsor and encourage educational programs.

A Most Welcome Pledge

Recently all members of the Zoological Society received a booklet, "To All Who Care About Tomorrow," outlining the Society's plans for development. Enclosed with it was an envelope in which gifts or pledges to the development fund could be made.

One such envelope was returned to the Society's offices with a note tucked inside. It said:

"My children and myself are joining in an effort to save and earn this sum of money for the Zoo. Therefore there is no money in the envelope. I hope that this way of achieving our contribution will mean more to them than if I gave it all in one lump and that you do not mind receiving bits and pieces."

The pledge was for \$250, over a five-year period. Needless to say, the Zoological Society does *not* mind receiving such a meaningful gift "in bits and pieces."

Crandall Book Accepted

The quarter-million-word manuscript of "The Management of Wild Mammals in Captivity" by General Curator Emeritus Lee S. Crandall has been accepted for publication by the University of Chicago Press. Because of its length, approximately a year will elapse before it appears.

Correction

Through a typographical error which dropped an "s" from the word "Photographs," it appeared that only the photograph on page 7 of the January-February *Animal Kingdom* was taken by Miss Emmy Haas. Actually, all the fur seal photographs on pages 7-11 were the work of Miss Haas.

Monaco has issued a series of postage stamps to honor "Man Under the Sea." The 1-franc denomination bears a reproduction of the Bathysphere in which Dr. Beebe and Otis Barton descended to the depth of 3,028 feet, then a record.



Academy of Sciences Monograph Dedicated to Dr. Gordon

The proceedings of the Fifth International Pigment Cell Conference, which were recently published by the New York Academy of Sciences as a 1,123-page monograph, have been dedicated to the late Dr. Myron Gordon. For twenty years Dr. Gordon was in charge of the Genetics Laboratory of the Zoological Society. The scientific research that he conducted with the fishes he maintained there, as well as his organization of the first four Pigment Cell Conferences, made him an outstanding leader in the field. In the dedication, Vernon Riley and Joseph G. Fortner of the Sloan-Kettering Institute for Cancer Research and Memorial Hospital pay tribute to Dr. Gordon's "warm personality and comprehensive scientific perspective" and to his recognition that the study of the pigment cell could serve ideally as a common meeting ground for medical men, biochemists, geneticists, embryologists, and members of other scientific disciplines. "It is our belief," they continue, "that the series of Pigment Cell Conferences which Myron Gordon, more than any other single individual, helped to create, represents a dynamic living memorial justly appropriate to a competent scientist and a great and simple human."

Expedition to Central America

The Aquarium's Geneticist, Dr. Klaus D. Kallman, is at present on a two-months expedition to Central America during which he will collect living fishes to be studied in the Genetics Laboratory. Dr. Kallman and Dr. Donn E. Rosen, Assistant Curator of Fishes at the American Museum of Natural History, did their first fishing in Guatemala, where they obtained a wide variety of freshwater species including some new to science and some that inhabited a hot spring with water the temperature of a warm bath. British Honduras is the next country that will be ichthyologically explored, and southern Mexico the last.

IN BRIEF

Boat House Is Gone. The Boat House on the banks of the Bronx River, in the southeast corner of the Zoological Park, has now been demolished

and the area is being landscaped. The Boat House was built in 1907 and for many years was popular as a center for boating, but the vogue for the sport has gradually declined and last year the building was gutted by fire. Only the dock remains and rowboats will be rented as usual during the coming season.

Spring Openings. The spring schedule of openings at the Zoological Park is:

Tiger Trains (Lecture Tours) . . .	April 1
Daily Tractor Trains	April 6
Farm-in-the-Zoo	April 6
Children's Zoo	April 13

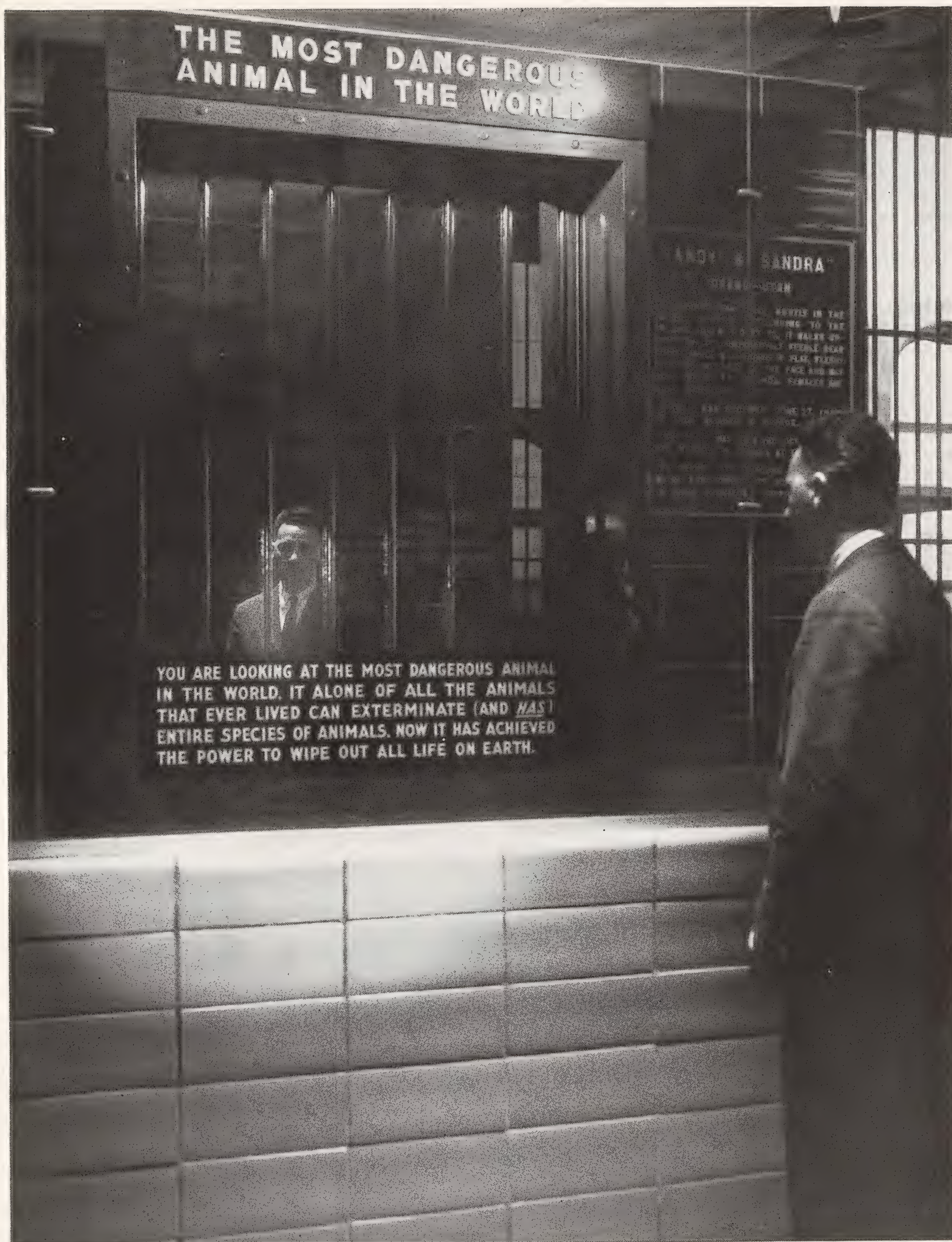
Other spring events are Curator-conducted tours for Members on April 27 (Birds), May 4 (Mammals), May 11 (Reptiles), May 18 (Aquarium), May 25 (Birds) and June 6 (Garden Party in the Zoo).

Octopuses at Aquarium. Two giant Pacific Octopuses have arrived safely at the Aquarium and are now on exhibition. The larger one weighs 50 pounds, has a stretch of about 12 feet and is still growing. Because they come from deep and cold Pacific water, they are being exhibited in specially refrigerated tanks where the water is kept under 50 degrees. Spectacular anemones and starfish were also received from the Vancouver Aquarium.

Course for Teachers. Teachers in the New York City schools are taking a 15-weeks course in the utilization of the Zoological Park in their teaching this spring. It is the fourteenth year that such courses have been given by the staff.

Miss Franz Honored. Miss Edith Franz, Assistant Secretary-Treasurer of the American Committee for International Wild Life Protection, was given a gold watch on February 13 to mark her twenty years of service to the committee.

Now a Paperback. "Our Plundered Planet," the book which Dr. Fairfield Osborn wrote in 1948 to awaken awareness of man's war with nature and to urge action before it is too late, has been published in a paperback edition by Little-Brown and Company of Boston, the original publishers. The price is \$1.95. Up to the present, the book has been published in nine languages.



This "Most Dangerous Animal" exhibit has been installed in the Great Apes House between the Mountain Gorilla and Orang-utan compartments and invariably visitors stop, stare at themselves in the barred mirror — and read the legend. "It's true!" is the frequent comment.

PUBLICATIONS OF INTEREST

INSECTS ARE WHERE YOU FIND THEM. Written and illustrated with many black-and-white drawings by Helen Damrosch Tee-Van. 80 pp. Alfred A. Knopf, New York, 1963. \$2.95.

Young entomologists are apt to start their careers with the insects they see around them, and it is not always easy to find accurate, instructive words and illustrations suited to the juvenile beginner. This is such a book. It defines the insect and generalizes about its way of life, pictures and discusses some three-score examples, is clear and concise about collecting and preserving and concludes with a charming chapter on insects in legend, literature, art and music. The pencil illustrations not only picture the insect, but show it in its usual habitat.

POSSUM. Written and illustrated by Robert M. McClung. 48 pp., many illustrations in color and black-and-white. William Morrow & Co., New York, 1963. \$2.75.

Mr. McClung has established a reputation for authentic stories and illustrations of the lives of familiar animals, and young children have an insatiable appetite for them. They will welcome this charming story of a Possum and its adventures in the wild.

MYTH AND MANEATER. THE STORY OF THE SHARK. By David Kenyon Webster. 223 pp., 7 text-figs., 22 photos. W. W. Norton & Co., Inc., N. Y., 1963. \$4.95.

During the past five years, sharks have attacked 18 bathers and skin-divers while they were enjoying the in-shore waters of South Africa, 30 from around Australia, and 31 along the Atlantic, Pacific and Gulf coasts of the U.S.A. As a result, 15 people died and several more were maimed for life. Such statistics indicate that shark attack is on the increase and for this reason, if no other, the most recent book on sharks ought to find a wide audience. Its author has collected an amazing number of fascinating facts about the relations of shark and man, including advice on how to avoid being attacked and what to do if faced by a potential maneater. Various aspects of the natural history of sharks are also treated in a lively yet informative way.

GROWING WINGS. By Sarita Van Vleck. Line drawings by the author. 128 pp. Doubleday & Co., New York, 1963. \$3.95.

In sixteen brief but fact-filled chapters Miss Van Vleck has outlined the bird's year, from spring migration to the problems of wintering. She has ranged through the birds of many countries for examples, but stresses the more familiar birds of the New World. The book can be strongly recommended to anyone who wants a broad introduction to the mechanics of the bird's year.

GOMA: The Gorilla Baby. By Ernst M. Lang. Translated by Edmund Fisher and Cornelia Schaeffer. 123 pp., 57 photographs. Doubleday & Co., New York, 1963. \$3.95.

With vivid awareness of both the scientific importance and the human interest of his observations, Dr. Lang has told the story of the first two years in the life of the Lowland Gorilla born in the Basel Zoo in 1959. Little Goma's mother obviously did not know what to do about her offspring, so the Langs (Dr. Lang is Director of the Basel Zoo) reared the infant in their own home. Few individuals may ever be called upon to rear a baby gorilla, but if they are — here is their Dr. Spock. The illustrations are as fascinating as the text.

LAND ALIVE. By Ronald N. Rood. 144 pp., illus. by black and white drawings by Edward J. Brundage. The Stephen Greene Press, Brattleboro, Vt., 1962. \$4.50.

A fascinating account of exploration of nature, season by season, on a hundred-acre Vermont farm. This is a family affair, father, mother and four children sharing their interest on a basis of equality. For while Mr. Rood is a trained and experienced biologist, he allows events to develop naturally, with the result that what might have been another "uncle" story takes on a particular charm of its own, with no hint of pedantry. Highly recommended for all ages. — L. S. C.

ORPHAN OTTER. By Arthur Catherall. Black-and-white illus. by Lloyd Sandford. 127 pp. Harcourt, Brace & World, Inc., New York, 1963. \$2.95.

A fast-moving story for children of the adventures of a young Otter in the wild, where man and beast are against him. It ends happily, however. The illustrations are by the Bronx Zoo's artist.

THE FISHES. By Uri Lanham. 116 pp., 6 text-figs., 43 photos. Columbia University Press, N. Y., 1962. \$5.00.

A brief, non-technical description of the fishes of today and their various ways of life, explained as a result of their evolution during the past 400 million years. The author's evolutionary point of view gives remarkable perspective and unity to a vast subject. More than a third of the book's striking photographs, including the frontispiece, were taken by Staff Photographer Sam Dunton at the New York Aquarium.

The Natural History Library

A NATURALIST IN ALASKA. By Adolph Murie. 302 pp., photographs. \$1.45.

ANIMAL BEHAVIOR. By John Paul Scott. 331 pp., photographs and drawings. \$1.45.

KNOWLEDGE AND WONDER. By Victor F. Weisskopf. 282 pp., photographs and drawings. \$1.45.

These well-printed paperbacks are new additions to the Natural History Library of reprints, published by Doubleday Anchor Books in cooperation with the American Museum of Natural History.

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ANIMAL KINGDOM

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THE MAGAZINE OF THE NEW YORK ZOOLOGICAL SOCIETY

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New Role for a Zoo

THE TIME HAS COME when the modern zoo must play a role in helping to preserve certain species of animals whose existence in the wild state is critically threatened. This is an objective, as well as responsibility, of which the larger zoological parks, both here and abroad, are becoming increasingly conscious. While the aid to all wildlife conservation must be directed principally to the protection of wild animals in their natural habitats, the fact remains that today the survival of some kinds of animals in the wild state is highly questionable. Many examples come to mind but among them are such as the crucial status of Gorilla, of Orang-utan, of Okapi and of the White Rhinoceros, as well as species of birds and reptiles.

Techniques in the care of wild animals have improved so greatly in late years that it is interesting to realize that all of the above mentioned mammals except the White Rhinoceros, have now been bred successfully in captivity — an accomplishment undreamed of not long ago. Zoos can harbor and successfully take care of animals that are at a crisis for survival, can maintain and foster breeding stocks as a reserve measure to prevent their total extinction, and perhaps eventually, in some cases, replace them in their natural environments under adequately protected conditions.

So it is that our Society, as part of its Development Program, is projecting a Wildlife Survival Center, directed principally to the above purposes but serving as well as a center of public education for the need of wildlife protection.

Fairfield Osborn

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City Mouse and Country Mouse, All in One - -

THE MUSKRAT

By DAVE MECH

Naturalist; Minneapolis, Minn.

WHEN I SUGGESTED to *Animal Kingdom* that I would like to write an article about that interesting little fur-bearer, the Muskrat, I mentioned that friends of mine had reported seeing it along the Bronx River within a very few miles of the New York City limits.

"Why go so far afield?" the reply came back. "Muskrats are common *inside* the city limits; we have plenty of them living wild in the Bronx Zoo itself and a few years ago we even found one running around the basement of the Zoo's Administration Building."

I might have guessed it, for I knew the Bronx

River with its often wild and muddy banks flows through the Zoo, and *Ondatra zibethica* in one or another of its races has managed to find a home wherever there is water, over most of North America below the Barren Grounds of Canada.

Although few country boys would make such a mistake, I suspect that some city-bred Zoo-goers, if they have actually seen Muskrats on the Zoo grounds, have taken them to be ordinary house rats — and large ones, at that. Muskrats are not *rats*, zoologically speaking. They are actually more closely related to the Meadow Mouse than to rats, being a member of the same family (Cricetidae).

The Muskrat's nearly naked tail is certainly reminiscent of the rats, but it is more than a tail. Laterally flattened, he uses it as a rudder as he paddles about the pond, swamp, river, creek or ditch that is his home territory. His partially webbed hind feet are especially useful for a semi-aquatic life. They propel him through the water at a rate of about two miles an hour. An extra lip lobe on each side of his mouth allows him to keep his mouth closed while he gnaws on submerged roots. Some naturalists claim for him the ability to stay submerged for as long as 13 minutes.

An adult Muskrat (which is not a rat, but is more closely related to the Meadow Mouse) is a rather imposing creature occasionally weighing as much as five pounds, with an over-all length of 21 inches.

Photo: U. S. Fish & Wildlife Service—V. B. Scheffer

Because of their size, Muskrats require comparatively little water for protection. Adults average 2½ pounds apiece, but some individuals attain a weight of 5 pounds. From nose to tip of tail, most adults measure about 21 inches, the tail accounting for almost half the length.

Muskrats must have a watery, preferably swampy, habitat, but they eat such a wide variety of foods, that food supply rarely limits their distribution. In marshes and shallow ponds, cattail, bur-reed and sweetflag are their main foods; and along creeks and rivers most kinds of aquatics, semi-aquatics, grasses, herbs and truck crops are utilized. But Muskrats are not completely herbivorous. They relish fresh-water mussels, and sometimes feed on dead fish and other carrion.

Housing is seldom a problem; Muskrats build their own houses. They construct lodges and

streambank burrows in which to make their nests. Lodges are built of cattail, sweetflag, rush or any other vegetation growing nearby. Usually a whole family participates. The animals gather the vegetation and pile it onto a small bush, log, tree, root clump, or any other solid structure in about 2½ feet of water. Where trash has been thrown into a marsh, they use crates, boxes, or even old tires for frameworks. When no supporting structures are available, they must pile a great deal of material on the bottom of the marsh and then work up from there.

In one night, a family can accumulate a 3-foot-high heap. They know how to take advantage of accidental aids. Dave Herbst, a biologist, was trapping Muskrats in Indiana, using live-traps large enough for raccoons and checking them daily. One morning he noticed a trap missing; in its place was a brand-new medium-sized Muskrat house. Closer examination revealed that the builders had used the trap as their foundation.

After an accumulated pile of vegetation protrudes at least two feet above water, the Muskrats burrow into it from below. Then they enlarge the end of the tunnel into a chamber approximately 20 inches wide and 15 inches high. In large houses (4 to 6 feet wide and 3 to 5 feet high), they often build two or three sets of tunnels and living chambers, lining each chamber with fine vegetation. Exits may be at the base of the houses, or as far away as 30 feet. In the latter case, there is a "plunge hole" near the center of the house and a subterranean tunnel extending from this hole to the exit.

Besides habitations, two other types of Muskrat-made structures dot the area of the community. The more conspicuous is the "feed house." Less than 2 feet wide and 1½ feet high, each house is a hollow shell containing one large chamber. Three or four usually surround each living unit, several yards away. After the surface of a marsh freezes, Muskrats take roots, stems and other edibles into these structures to eat, gaining protection both from the elements and from their enemies. In addition, they visit feed houses to catch their breath when long distances from the main lodge.

The second structure is the "push-up." It serves the same functions as the feed house, but in a lesser way. Push-ups are merely accumula-



tions of wadded aquatic vegetation stuffed up into holes in the ice. The holes may have been kept open while the ice froze, or they may have been gnawed open by the Muskrats. In the Lake Erie region, push-ups were found in ice 8 inches thick. As more and more material accumulates, an air pocket is formed. The vegetation helps keep the hole open, and the Muskrat thus has another breathing place.

Along creeks, rivers, ditches and other water areas lined by high banks, Muskrats live in burrows with underwater entrances. These tunnels usually extend into the bank for a few feet before bending upward. Then they may continue for several yards or they may end abruptly in a well-lined chamber. Older tunnels are more complex, frequently consisting of an elaborate maze of side burrows, branches and parallels, and perhaps several living chambers. Often a vent, the width of a half dollar, extends to the surface, thus providing the network with adequate ventilation.

A swampy area in the New York Botanical Garden has supported a colony of Muskrats for many years. This is a winter Muskrat house in the Garden, easily visible from a major road leading to Pelham Pkwy.

From a Kodachrome by Dr. Theodore Kazimiroff

If this hole gets too large, the inhabitants of the burrow plug it up with balls of well-matted vegetation.

Although burrows and lodges generally are built in fall, they are renovated in spring just before the first litter of young is born. The date of birth of the first young varies with latitude; early April is usual in the northern states.

The eyes of newborn Muskrats are closed and they are naked and helpless. They weigh about 23 grams (28.35 gm. equal one ounce) and are about 4 inches long. According to Howard Erickson, who studied the growth and development of young Muskrats, within one week the weight of the newborn about doubles. By this time the umbilical scab has fallen off and the incisors are

breaking through the gum line, lowers first. The eyes open after about two weeks. When the nestlings are 18 days old they weigh about four times their birth weight. They are weaned sometime in their third or fourth week and soon they discover that there is more to the world than the inside of their lodge. The young Muskrats continue to gain weight rapidly, and when 7 weeks old weigh about 270 grams — almost 12 times their weight at birth.

By the time the young are that old, a second litter usually has arrived. The gestation period is 28 to 30 days and the young are dependent for about a month, so in the northern states there is time for the production of three litters, which is the number that some animals actually bear. In the South, five litters may be born. The average

Muskrat litter size is about 6, with extremes from 3 to 9.

Mass production in nature usually is accompanied by mass destruction, and the Muskrat is fully subject to this rule. One of the factors that helps keep Muskrat populations under control is predation. Mink, horned owls, hawks, foxes, coyotes, bobcats, wolves, dogs, and raccoons are among the Muskrat's enemies, the last two being especially good at digging into the lodges and "dislodging" the nestlings. But predators generally are not able to take many Muskrats unless

A biologist examines the inner structure of a Muskrat house that has been largely destroyed. Two or three sets of tunnels and living chambers provide snug accommodations; the exit may be 30 ft. away.

Photo by the author



the population has been subjected to some other stress, such as drought, flood, disease or overpopulation.

Overpopulation probably is the most important factor in predation. Unless especially high mortality occurs between spring and fall, there will be four or five times the number of individuals on a given marsh in September as in April. Obviously, any marsh can support only a certain number of Muskrats and no more. It turns out that each mated pair occupies an area with a radius of about 200 feet, and woe betide any individual that intrudes into this territory, unless he is much stronger and able to drive out the original occupants.

Thus a great number of displaced Muskrats wander about on each marsh during summer and fall. These itinerants are at a substantial disadvantage, and unless they locate a suitable home, they are likely to become tasty meals for their enemies.

One result of the population pressure is the wide dispersion of young Muskrats. This accounts for the "mysterious" appearances of Muskrats on isolated farm ponds before the ponds are even finished. Tagging studies show that 25% to 45% of a population present just before the "fall shuffle" may be absent just after it. During the spring mating season, movements are even greater. Evidently this movement is a result primarily of the young males' quest for mates. The distances traveled vary according to local conditions. In central New York, the average distance that 39 tagged Muskrats moved was 734 feet, but several individuals wandered for a quarter mile or more. In Alabama, a male Muskrat traveled about eight miles within a month.

Although many Muskrats disperse from the areas of their homes, others seem to have a strong drive to return to their home ranges if they have been artificially forced to move. An investigation of this "home tendency" in Muskrats was made by Howard Erickson: "Homing data were obtained from 19 ear-tagged, immature and adult muskrats released one or more times at varying distances and directions from home ponds. Some animals were released on other ponds, others along roadsides. Eleven of the 19 muskrats homed once. One muskrat homed five times, from north, east, south, west and northeast. His longest re-

turn was 4800 feet overnight. An immature female returned over one mile (5400 feet), the longest homing distance detected. Detailed examination of data revealed that muskrats had homed uphill, downhill, through woods, over small intermittent streams, past other ponds, and during clear, cloudy, and rainy weather. They returned from pond and roadside release sites located in all directions from home ponds."

The Muskrat is popular with biologists as an object of study, for it is common yet it has substantial commercial value. Don't look now, but your wife's "Hudson Seal" coat may have belonged to several dozen muskrats! So may coats labeled with the following pseudonyms: Odatra Mink, Electric Seal, Red Seal, Red River Seal, Plucked Beaver, Bisam Mink, Silver Muskrat, Water Mink, River Mink, River Sable, Russian Otter, Velvet Coney, Wallaby. The Muskrat's fur is very popular, but his name obviously isn't. Since the fur can be processed in so many different ways, it can be made to imitate several other furs and can then be assigned exotic names. Recent laws have curtailed much of this deception.

Millions of Muskrats are harvested annually throughout the United States and Canada. Every winter an army of professional trappers, farmers, farm boys, and even city youths take to the marshes and streams, in quest of "rats," as they call them. They set their traps in burrows, runways, slides (places where Muskrats habitually leave and enter the water), and wherever else they find evidence of recent use. In the late 'forties, a pelt brought as much as \$3.00, but today \$1.00 is about average. This still makes it worthwhile for many people to continue trapping, and it is much better than the 10¢ paid for a pelt in the 1800's.

Of course, a species doesn't have to have a monetary value to make it interesting or important. One of the things I like best about the Muskrat is its ability to live in and near cities and towns. Anyone with the slightest interest in nature can seek out this species and can learn about its habits by examining its tracks, droppings, food, houses and burrows, if not by observing individuals directly. Thus not a few naturalists and zoologists owe a debt to the Muskrat for stimulating their early interest in nature.

What Better Name for a Frogmouth?

By PETER L. AMES

Ornithologist

OF THE APPROXIMATELY 650 species of birds displayed in the Zoological Park, few are less graceful or less noticed than the Tawny Frogmouth. It has neither the dazzling color of the Cock-of-the-Rock, the fierce majesty of the Martial Eagle nor the delicate grace of the Sapphire Hummingbird. Few visitors pause more than a moment in front of the Frogmouth, and most who do are probably halted by the stern ugliness of his form rather than by wonder at the why of it. Certainly he does not call attention to himself by activity; he just sits. It is a pity he is not more noticed, for the Frogmouth is one of Nature's special works.

The flight of the Frogmouth is as noiseless as that of an owl, thanks to the softness of the plumage and serrated edges of its feathers. As an insect-hunter, it is a very skillful flyer.

Photo by W. G. Conway at St. Louis Zoo





Like their cousins, the nighthawks and whip-poor-wills, the Frogmouths are predominantly gray and gray-brown in color. The degree to which their color matches the bark of the branches on which they perch is remarkable and partly explains why relatively little was known of their habits until recent years. Frogmouths reach considerable size; the largest species of *Batrachostomus* reaches a length of nineteen inches. Our Tawny Frogmouth (*Podargus stri-gioides*), of southeastern Australia, is about sixteen inches long. For many years, European scientists familiar with the "Nightjars," which hawk for night-flying insects on the wing, believed that the Frogmouths simply flew along open-mouthed,

When a Frogmouth was shown an owl in the Bronx Zoo, it excitedly ruffled its feathers and rhythmically rose to its full height and then crouched.

Perched on a tree branch by day and sitting stiffly and motionless, the Frogmouth can readily be overlooked among gray, brown and mottled limbs.

Take his beak, which gives him his somewhat uncomplimentary if well-deserved name. Extending almost from ear to ear, it opens to reveal an enormous mouth colored a surprising chartreuse. No doubt this bright lining has contributed to the myth that Frogmouths feed by waiting open-mouthed like a tropical flower until a moth or small bird drops in for nectar. Then — snap!

Frogmouths constitute one of five families in the order Caprimulgiformes, collectively known as Goatsuckers. The order abounds with odd names, among them the American species named after their calls, "Whip-poor-will" and "Chuck-wills-widow." It is natural that night birds, far more often heard than seen, should be named for their calls, and the Frogmouths are no exceptions; the Tasmanian species is often known as "Morepork" from its strange cries. The twelve species of Frogmouths are classified in two genera; one, *Podargus* (from which we get the family name, Podargidae) inhabiting Australia and New Guinea, the other, descriptively named *Batrachostomus*, from India and Malaysia.

scooping in moths and large beetles. Stomach analyses showed, however, that the food insects were mostly of crawling instead of flying kinds. Then there was the "flower" theory. It was easy to envision the Frogmouth sitting open-mouthed, like a lovely yellow bloom improbably growing on the end of a dead snag, awaiting the visit of a succulent moth. The idea gained credence with the report by Frances Irby, an Australian ornithologist, that her young pet Frogmouth would catch insects by the flower system, the catch being made with a loud snap of the bill. At other times the bird, which was wing-clipped to prevent its flying away, hunted for insects on foot. It is now known from field observations that the Frogmouth gets much of its food in the form of insects and mice picked from branches as it hovers. One might wonder how a bird as large as a Frogmouth could catch a mouse by hovering and snapping at it, even with so large a beak. The answer lies in the softness of the bird's plumage, which renders the flight as noiseless as that of an owl. Indeed, the specific name



strigioides refers to this owl-like quality. The serrated edges of the feathers dampen the rushing sound that is heard when a sharper feather cuts the air. Despite his ungainly appearance, *Podargus* is a skillful flyer, capable of sharp turns and quick stops.

It is all very well to look like a dead stub when you are perched, but how do you conceal your nest? Naturalists disagree on the form of the Frogmouth's nest. It has been described as a pad of bark, lichen and moss, often composed partly of the bird's own down; other observers report that it is a bulky affair of twigs placed in a crotch of a limb. Both types of nest have been photographed with Frogmouths incubating eggs and brooding young, so obviously the nest pattern is not rigid. The one or two white eggs are incubated by both parents. The young bird is all head and beak, attached to which is a small body covered with white down. During this vulnerable period the young are brooded by one parent, who covers the chick with the concealing, bark-like feathers.

Having only a single individual in the collection, we have not had the pleasure of breeding Frogmouths, but at least we can enjoy hearing the booming call which is uttered only after dark. This is no lilting song like that of the Whip-poor-will, nor the nasal "*peent*" of the Nighthawk, but more like a series of short blasts of a foghorn heard from some distance. One can envision the Frogmouth, his great gape open, sending his deep booms into the blackness of the jungle — only it is not quite like that. Our Frogmouth calls with his mouth closed, only the tell-tale throat movements indicating that he is really the one producing the sound. Nor does the sound have great carrying power; it is doubtful that it would carry more than fifty yards through thick foliage.

Squint your eyes a bit when you look at our Frogmouth and imagine him high on a dead tree. Can't you readily believe that if the light were behind him, you might actually mistake him for a broken stub of a branch? If you are lucky, he may break the illusion by yawning for you.

Prelude to Management - -

Home Life of the African Elephant

By IRVEN O. BUSS

*Professor of Wildlife Biology
Washington State University*

AN INTENSIVE STUDY of the life history and ecology of the African Elephant is long overdue and probably no facet of such a study would contribute more to a comprehensive understanding of the animal than a project on behavior.

Consider family groups of elephants congregated into a closely-knit herd as an example. Such herds are of common occurrence on elephant ranges and aptly demonstrate the animal's remarkably gregarious nature. The family groups I have observed were bonded together by integrity and great devotion. When an elephant is shot from a family group, other family members gather quickly about it; they "paw" the ground, trumpet, charge and attempt to cover or carry away the dead elephant. On some occasions this behavior continues for nearly two hours.

Elephants are very adaptable, too, thriving from altitudes near snow level in the Ruwenzori Mountains of Uganda to desert-like areas near sea level in other parts of their range. Such wide dispersal is possible because the elephant's diet is virtually unlimited, varying from peanuts to coconuts, cotton bolls to sugar cane, and grass (probably its most staple food) to terminal parts of trees and shrubs. Its bill of fare is as diverse as the kind of range it occupies.

Added to these traits are the elephant's exceptional intelligence and memory which, according to Bernhard Rensch in the *Scientific American* of February, 1957, probably result from the large brain and the bigger ganglion (gray matter) cells with their large nerve fibers. But despite all these remarkable characteristics and the widely recognized fact that the elephant is the largest land mammal in the world, no detailed behavioral study of the animal in its natural environment has been made.

That situation is being corrected, however. An elephant project was initiated in Kibale Forest in Uganda in October, 1962, under the sponsorship of the New York Zoological Society, the Conservation Foundation and Washington State University. Supporting funds are from the National Science Foundation, the Forestry Department of Uganda and the New York Zoological Society.

THERE IS, of course, plentiful anecdotal knowledge of elephants, but it is of questionable scientific accuracy, having accumulated since petroglyphs were carved in caves during the Upper Paleolithic Period. Aristotle said the elephant lived to the age of 300 years, Cuvier reckoned 200, De Blainville postulated over 100 years, and even today these baseless guesses are repeated. Numerous writers from Pliny to Buffon claimed that the elephant shows particular aversion to pigs, warthogs, horses and dogs. Until the XVIIth Century it was believed that elephants worshipped the sun and the new moon. Perhaps the most venerable delusion was the one propounded by Sir Thomas Browne in his *Pseudodoxia Epidemica* in which he said the elephant has no joints. Many of these myths, prejudices, superstitions and faulty reasonings have been perpetuated to the present time. Typical examples include the popular tales that elephants seek an "elephant cemetery" in which to die, that shoulder height equals twice the circumference of the front foot and that "musth" indicates a dangerous breeding male elephant. One of the most fantastic tales of African folklore, published in *The Sunday Times* for August 18, 1957, reported elephants tearing tusks from animals that had escaped the hunters and died deep in the forest, to deprive their enemies (man) of the ivory.



Opportunities for a project on the behavior and ecology of the African Elephant are dwindling fast. Many writers, both technical and popular, note that it is becoming increasingly difficult to observe the African Elephant in completely natural environments. There are today very few populations from which quantitative biological data can be obtained. One of my studies shows that in 1929 elephants occupied approximately 77 percent of the land area of Uganda, but by 1959 probably at least as many elephants were crowded into only 17 percent of the land. This change reflects the accelerated pace of human population increase in Africa and the resultant land-use conflict between men and elephants. Obviously, the growing demand for food, clothing and housing will result in the irreversible conversion of many important wildlife ranges to other uses, from sawmills to coffee plantations, and paved freeways to apartment houses.

The continual compression of elephants into smaller ranges, and interference with elephant

Elephants ranging in size from babies to adults in this family group support observations of breeding throughout the year — and also indicate that the African elephant has a thrifty reproductive increase.

Photo copyright Aero Service Corporation

migrations, are unquestionably changing the pattern of elephant behavior over most of its present range. It seems important, therefore, that scientific studies of the African Elephant should be conducted now while completely natural environments still exist, for it is only there that elephants and other animals reveal the higher possibilities of their nature and behavior, and the full range of their individual diversity.

An unusually high density of elephants in some of the forests and savanna lands of western Uganda provides an exceptional opportunity for studying this animal. During 1958 and 1959 I made a series of observations of two different populations in this area. The interpretation of morphological and behavioral data on a number of individuals resulted in three principal conclusions. Morphological characteristics, volume and



kind of food present in stomachs, and feeding habits of individuals within each group were similar but varied conspicuously among groups. The groups of elephants studied represented closely related or family units, and their behavior suggests a leadership type of animal organization.

Numerous observations indicated subgroupings or family units within large herds, with a leader in each family unit. This type of social organization has certain definite advantages. A study of the howling monkey by C. R. Carpenter in 1934 revealed subgroupings within groups, and showed that the strength of the bond between

a female and her young rose and then declined as the infant grew older. The notable work on imprinting reported on other animals by Konrad Lorenz in 1935 indicated the importance of a parent or leader during early life. Such leadership is vital to the establishment of many behavioral characteristics which, according to other investigators, have an amazingly high degree of adaptiveness. More recently, scientists concluded that leadership allows greater flexibility of behavior than is usual in territorial or hierarchal organizations. Surely few animals have greater adaptive resilience (ecologic amplitude or in-

herent capacity to adjust to changing environments) than the elephant.

THE COHESIVE BOND among members of an elephant group, their exceptional adaptability and their remarkable learning ability and memory suggest that they are second only to man as the potentially dominant animal on earth. Yet relatively little is known about their behavior in natural environments. What triggers the family group to assemble with other groups into a huge herd for migration? Do family groups maintain their integrity throughout the migration periods? Is migration important to the elephant's survival? How are plants and other animals affected along migration routes or where elephants concentrate for variable periods of time at the end of their migrations? As elephants are forced into progressively smaller ranges, will their birth rate decline with increased density as in some other mammals, or will their high intelligence result in a "hysteria" type of reproductive response similar to human reproductive rates during war? These are but a few of the many questions and suggested opportunities arising from the preliminary studies that have been conducted on this mammal.

Observations which I obtained in 1958-59 showed that soon after the dry season began in early November, elephants on the savannas began to assemble into herds and migrate from the grasslands into the forests and swamps. Aerial

A young bull elephant in a typical defensive attitude — ears cocked and the trunk straight ahead and angled backward from the tusk line. An elephant's emotional state is usually very evident!

Photo copyright Aero Service Corporation

counts on savannas during the dry season were lower than those made during the rainy season. Field observations indicated that elephants concentrated in the forests and near permanent water supplies in the dry season, resulting in overutilization and possible extirpation of some food plants at these sites.

With the onset of the rainy season in late March, many of the elephants congregated into large herds preparatory to their emigrations from the wooded and swampy areas. Herds composed of at least 100 elephants were not uncommon. All of the herds I observed during late March

and early April were leaving forest lands and moving toward savannas where water was again available and elephant food was more abundant. By mid-April, the migration of elephants to the open grasslands ended. Some of these migrations were probably 100 miles or more in length; others were probably less than 10 miles long. While recently conducting a wildlife survey in Kenya, my friend F. Fraser Darling noted that during the dry season in the Mara elephants occupied the dense forest, whereas during the long rains they ranged over the whole area.

In comparing the 1929 distribution of elephants in Uganda with that for 1959 (*Journal of Wildlife Management*, January, 1962), Allan C. Brooks, formerly the Game Biologist for Uganda, and I concluded that changing the pattern of migrations was one of the most significant causes involved in distributional shifts between 1929 and 1959. Numerous populations which were formerly linked together by broad travel lanes are now connected by narrow corridors. Some of the smaller populations are entirely isolated from major populations.

It is possible that restrictions imposed on elephant migrations have far greater and more subtle effects than is generally realized. For example, in northern Tanganyika near the rim of Ngorongoro Crater, elephants make regular excursions to the crater wall where they pry loose and eat bits of soil. Unpublished data on chemical-elemental analysis of these soils indicates that they are rich in trace elements, particularly cobalt and manganese. Both of these metals are important to an animal's physiology.

During migrations, some elephants move through forest reserves where they live temporarily. Other herds probably live primarily in forests, getting the bulk of their food from grasslands at the forest edge or in forest openings. Here they create a difficult problem. They cause serious damage to both natural forests and plantations. The problem grows continually because increased settlement and cultivation of surrounding lands forces the elephants to concentrate more and more in the forest reserves. As the demand for forest products increases, high elephant populations causing damage to commercially important timber become progressively more difficult or impossible to tolerate in the forests.

In most of the forests of the Western Province of Uganda, the reduction in elephants necessary to allow increased timber production will probably not create a serious problem for the elephant. However, the Kibale Forest, an important timber-producing forest in Toro District of western Uganda, straddles one of the main migratory routes of the elephant and possibly serves as an elephant reservoir for the nearby Queen Elizabeth National Park. Any appreciable reduction in the elephant population of this forest may have significant effects on the behavior, ecology and status of populations in Queen Elizabeth National Park and other populations using the migratory route through Kibale Forest.

Recently, investigators in Denmark removed roe-deer which were living in a forest and introduced 24 new animals from an estate where deer lived in the fields. The transplanted deer retained the same behavior for about three months; then they changed their habits and reverted to

those of woodland deer like their predecessors. Although roe-deer and elephants might be able to live on ranges without forests, behavioral changes which would probably result from such range modifications might lead to deleterious effects on populations. As previously mentioned, elephants tend to congregate in forested areas. It has been suggested by other investigators that this habit of congregation has some inherent survival value, particularly for large ungulates. Investigations of other animals indicate that large bands may be formed in a suitable environment, but elsewhere the condition may not allow grouping. It is possible, therefore, that banding by elephants during migration is very important and that forests play a crucial socio-ecologic role in congregation.

INVESTIGATORS working on the project are probing into the intimate life of elephants and obtaining data on their behavior and ecology, with special emphasis on the extent to which ele-



phants are dependent on the forest for their continued prosperity. Secondly, this investigation seeks data on the relationship of elephant behavior to reproduction in a dense or compressed population and to phenomena of migration. It is anticipated that the studies will yield information useful: (1) for an assessment of the survival value of migration, (2) for a more comprehensive understanding of faunal and floral relationships in forests where elephants concentrate during migratory periods, and (3) for a broader understanding of reproduction.

Various techniques will be used in fulfilling the project's objectives. Elephants will be temporarily immobilized by delivering a harmless drug-carrying dart into the shoulder or neck area. A 20-gauge gun with rifled barrel for long range accuracy has been constructed to deliver the drug. The immobilized animals will be marked by one or more of the following methods: fitting a very small radio transmitter mounted in a solid

The elephant spends so much time feeding that it is a wonder the 24-hour day is long enough. While it eats many kinds of food — from peanuts to coconuts, grass and leaves — it is a selective feeder.

Photo: Uganda Game Department

plastic collar around the elephant's neck, attaching brightly colored 3-inch by 12-inch polyvinyl streamers in the elephant's ear, painting very large numbers on the elephant's rump, and attaching a bell to the elephant's tail. Marking efforts will be directed to elephants observed leaving Queen Elizabeth National Park in the direction of Kibale Forest and to elephants in and near Kibale Forest. Where possible, behavior of marked elephants will be compared with behavior of other individuals for possible behavioral differences caused by these markings. The markings will cause no real discomfort and are essential if adequate information is to be obtained that will aid in formulating management programs necessary for the long-term protection of these great animals.

Signals from radio-carrying elephants can probably be received at distances up to a mile, thus making it feasible to use an airplane in locating such animals. The airplane, with a special transceiver, will criss-cross migration routes, forests and savannas where marked elephants are

likely to congregate or migrate. Auditory and visual identification of marked elephants will provide valuable data on movements, time spent in particular areas, integrity of family groups and numbers of animals living in Kibale Forest at various times of the year. If one individual of a family group is marked and the total number of elephants in such a group is determined, subsequent observations of the marked individual will facilitate identification of the herd. Where marked individuals of family groups congregate into large migratory herds, such herds can be followed from day to day for information on migration, concentrations during dry seasons, and dispersal to home ranges on savannas. An airplane will also be used at irregular intervals to locate elephants and to attempt to follow extra large herds. Past experience indicates that an airplane cruising normally above 800 feet will not distort observations made on elephants.

Comparison of behavioral information on marked bulls in a dense and a sparse population could provide valuable information on reproduction, particularly for interpreting some of the data obtained in a study of spermatogenesis from elephants collected in Uganda.

When feasible, herds of elephants with marked individuals, or animals with diagnostically broken tusks, conspicuous scars or lacerated ears will be followed on foot as long as possible to obtain observations on their behavior.

Four aerial counts of elephants will be conducted during August, October, February and May of 1963-64 in an area encompassing part of Queen Elizabeth National Park and the savanna area between the park and Kibale Forest. Changes in distribution of elephants on the area, differences in total numbers recorded for each count, proportion of calves present, and the location of marked elephants will be studied.

The problems associated with the preservation of the elephant, or any other animal that cannot adapt to or be tolerated on lands dedicated to agriculture, must be solved before a plan for successful management and protection of the animal is possible. It is intended and hoped that the elephant research studies now in progress in Uganda will provide enough relevant information on these problems for the framework of such a sound management plan.

A Morning in the Reptile House

Photographs by SAM DUNTON

Staff Photographer

Early morning chores around the Reptile House, between 8 o'clock and the opening of the Zoo at 10 o'clock, are mostly matters of cleaning and feeding. When it comes the turn of the Indian Pythons (the largest 13½ ft. long), they know they will be allowed to explore the service area behind their compartment while the keeper works, and glide toward the door the moment it is opened. They used to climb a staircase in the background until a snake-proof screen was built.





The most dangerous animal in the Zoo is probably the Nile Crocodile, for it invariably rushes the door of its pool when it has to be opened for cleaning. Steve Spencook, Head Keeper of Reptiles, managed to drive this attack back with the hose, as he does every day.

By contrast, cleaning the King Cobra's compartment — in this instance, removing a shed skin — is a comparatively simple matter; the big snakes are not readily alarmed and seldom even approach the shield that Head Keeper Spencook uses to block the doorway.





There are nearly a hundred turtles in the Turtle Pool and they crawl up from all directions as soon as the door is opened and their food of lettuce, ground meat and bone meal is offered. They return to water to eat.

Since we put an ultraviolet sunlamp in this lizard compartment, there has been an enormous difference in readiness to feed. Lizards rush to seize bits of lettuce, grated carrot, chopped banana, dandelion blossoms and bits of ground meat.



Feeding time in the "Crocodilian Nursery" always draws visitors as the young caimans and alligators swarm up the ramp to take bits of fish. They may be babies, but they snap quickly and the fish is always offered from long forceps—and even it is sometimes seized and shaken.





For many years snake mites have been the bane of every Reptile House but we have almost eliminated them by the use of a substance called Diazinon 25E. In a dilution of 1 to 250 in water we spray compartments and snakes indiscriminately, and find that spraying twice a year is usually enough. Here Keeper Brandner gives a spraying to a lizard-tortoise exhibit.



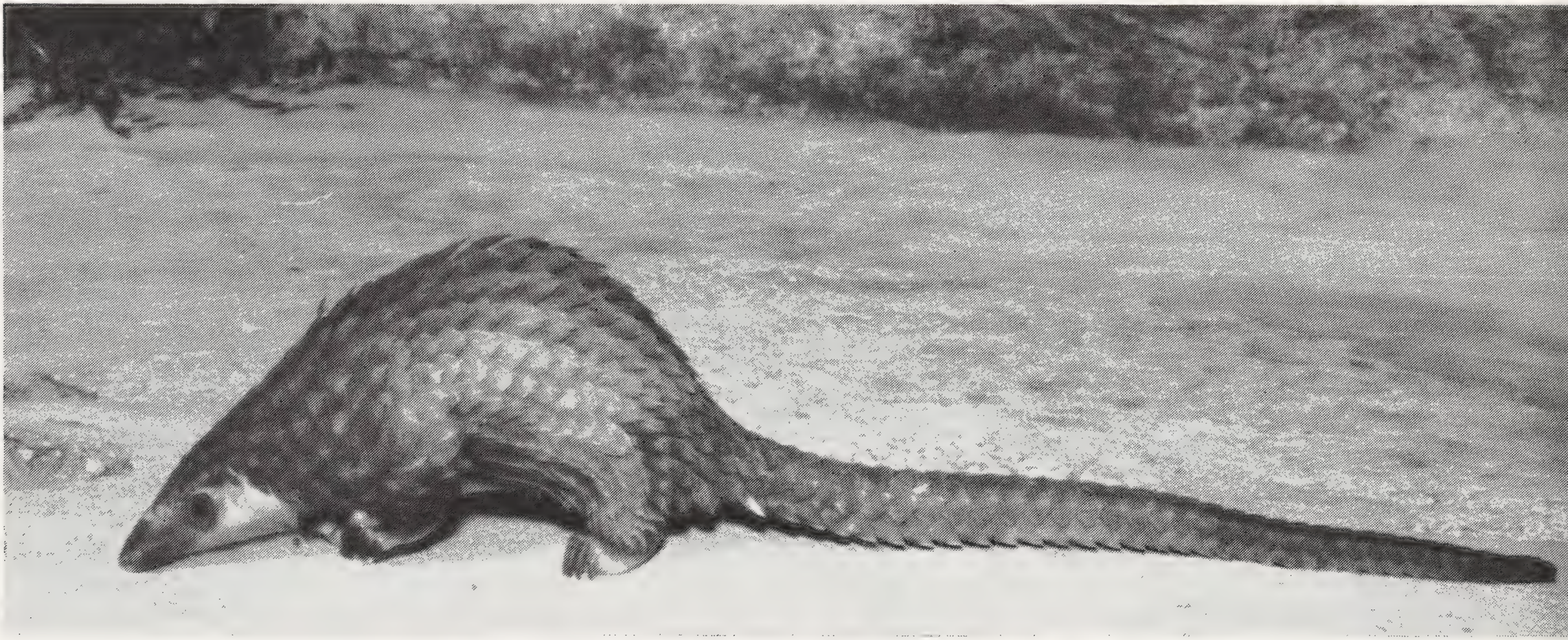
Turning the Giant Tortoises out for the day is one of the most time-consuming jobs, for the tortoises like to stop and — presumably — think a while before making more than a step or two. The one on the left is our largest, a 440-pound specimen from Isabela Isl. in the Galapagos Islands; the one on the right is a somewhat smaller giant from Aldabra Island.

No day at the Reptile House is "normal" unless someone brings in a donation — usually a snake, a tortoise or a frog. This visitor presents to the Head Keeper a Hog-nosed Snake captured by Gregory Gaul, his grandson, near Carmel, N. Y. The grandson will receive a formal acknowledgment of his gift — and if he is like most boys, will treasure it.



A quarter after 10 o'clock — and the Reptile House is beginning to fill as buses deliver hundreds of school children to the Zoo. Many counts have been made but the Reptile House always ranks first in popularity with visitors to the Zoo.

ABOUT PANGOLINS



AND ARMADILLOS

By Miss S. K. SIKES

*Department of Zoology, Ahmadu Bello University,
Zaria, Northern Nigeria*

IT CAN BE SAID of a very large number of animals, unfortunately, that our knowledge of the living species in their natural habitats is abysmal. Take, for instance, the armadillos, sloths and anteaters that comprise one zoological Order, with the pangolins in another and the aardvarks in still a third. There is so much we do not know!

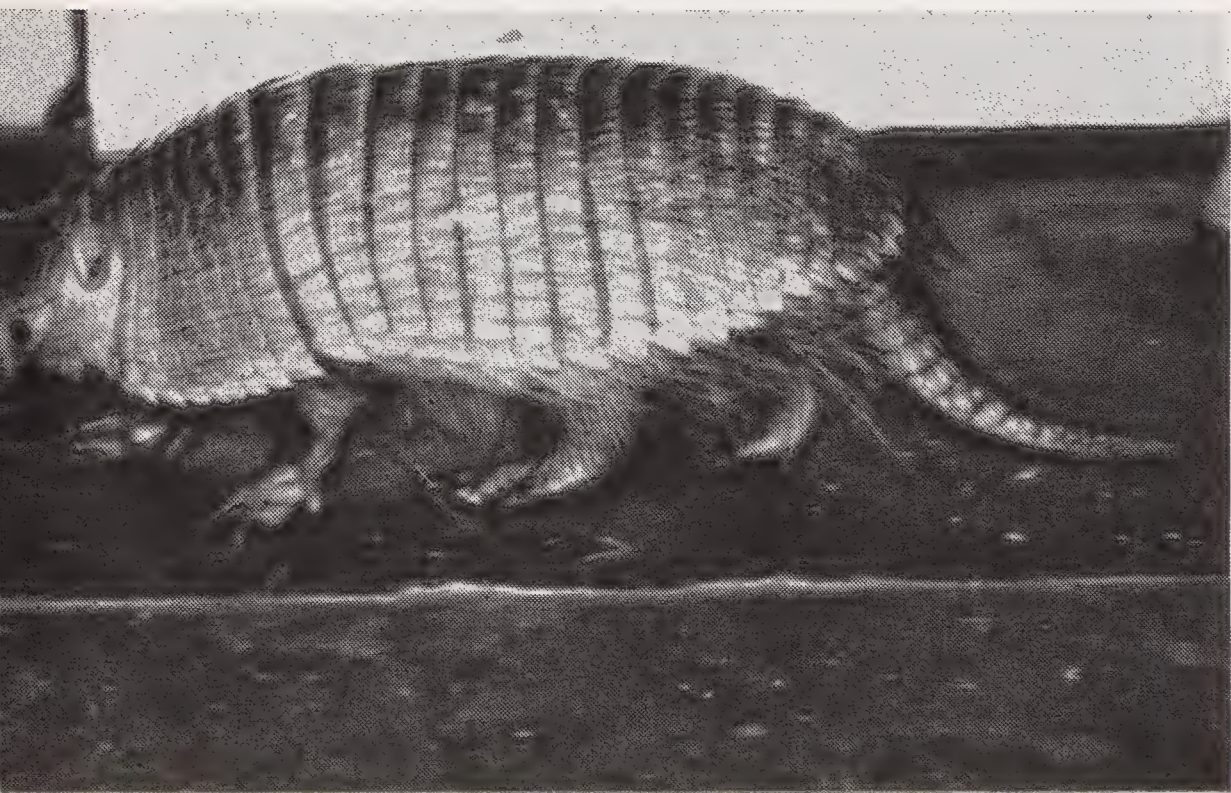
One misleading thing about the three groups is that they have a number of features in common whereby they are adapted to certain similarities of habit and home. With individual exceptions — such as the sloth — all have tubular mouths, sticky tongues, heavily clawed feet, queer adaptations of the skin and a tendency to roll into a ball. In the circumstances it is not surprising that a good deal of confusion arose in the mind not only of Darwin, but also of many people today, re-

garding these animals. The tendency in Africa to refer to the pangolin as an “armadillo” reflects this confusion. My intention is to draw a comparison between the New World armadillos, *Dasypus*, and the African pangolins, *Manis*, which, on personal acquaintance, are the more readily seen to be zoologically poles apart. The third group, the aardvarks, are, for the immediate purpose, omitted.

African pangolins all belong to the Order Pholidota, and there are four recorded species. Although found in most parts of Africa, south of the Sahara — and their scales can frequently be found as ingredients of witch-doctors’ and wizards’ traditional medicines — they are by no means common, and only rarely seen or kept successfully in captivity. The reason for this is mainly their own most efficient natural camouflage, and their strictly nocturnal habits. In contrast, the true armadillos are all native to the New World and belong to the Order Edentata. This order includes the true armadillos, the true sloths, and the giant anteaters.

In order to develop the comparison, considera-

tion may first be given to the true armadillos of South, Central and North America. These may lay some claim to fame through the publicity given by Darwin to their mighty ancestor, *Glyptodon*, the now extinct monster armadillo, whose dome-shaped, armor-plated carapace was used by pre-historic Argentine man as a splendid "pre-fab" house. *Glyptodon*, whose yard-long, armored tail bore a spiked club up to eight inches in diameter; *Glyptodon*, whose last mortal remains now lie in the La Plata and other museums, revered by modern Argentine man. Today, modern armadillos do not attain the dimensions of their ancestor, but range in size from the tiny Orange Armadillo (three-banded) to the so-called Giant Armadillo of Argentina and Paraguay. The commonest of all the modern armadillos is the "Hairy Armadillo," *Dasypus villosus*, and it is with this species that I have become best acquainted. It is unhappily regarded as a pest by



the *estancieros* of Argentina, and as a particularly tasty morsel by the *gauchos*. True, its excavations in the cattle pastures do not improve the latter, but, on the other hand, its scavenging habits are of the utmost assistance and importance to the farmer.

In order to become personally acquainted with the Hairy Armadillo, it must first be captured, and as soon as one tries to do so, some of the amazing adaptations to its way of life are revealed. Try first at night, with car lights or torches, to illuminate the foraging animal. Then run at full speed and fall upon the fleeing creature. It is harmless, so you may grab it with your hands. It *should* be easy, but alas, almost every time one grabs, it has already got out of arm's

reach down a burrow, or it is already digging itself straight down, belly first, into the soft, sandy Argentine soil. Try to prize it up with your fingers, and your gashed, cut hands will warn you against a second attempt.

There are two methods more likely to ensure success — the first using dogs to run down the animal, and the second by craft, making use of the armadillo's gluttonous habits as a scavenger.

The first is not to be recommended, because the dogs often damage the specimens caught. The second is the best, but to appreciate it one must first try to visualize the vast flat *estancias* of Argentina, fenced to form extensive pastures containing grazing stock. Here and there, where a dune area has formed, a few trees may have been planted and the area fenced, to prevent erosion. These dune areas are used as the farm cemeteries, and there any carcasses of cattle, horses, sheep, etc., which may have died are thrown. They are neither buried nor burnt; just left. There are no real vultures and few of the usual four-footed scavengers, and the only available clean up squad consists of small hawks and beetles — and the armadillos. Under and around each recent carcass may be found numerous new armadillo burrows. The armadillos gorge themselves until they can no longer walk or roll up, and fall asleep flat on their backs under the carcasses, or in the mouths of their burrows. This is the collector's best opportunity.

The eye of the White-bellied Pangolin of Africa is rimmed with protective bristles and the body has a layer of overlapping scales from snout to tail-tip. The Hairy Armadillo of South America is equally well protected as it plods on its flat-footed way.

All photos by the author

Having caught some armadillos, one must determine their sex and arrange feeding and accommodation. The determination of sex, to the newcomer to the realm of armadillos, is confusing, but the local *gauchos* absolutely assure one that those which one is convinced are all males are really a mixed bunch. *Gauchos* find the subject delicate, and one must not ask for explanations. As to feeding, the *gauchos* assure you that armadillos never drink water (although they assert that the animals suck milk from recumbent cows on occasion), and the *estanciero* holds the

same belief, adding that if they drank water (usually only available in the raised cattle troughs) then he would expect to find an occasional drowned armadillo. He has never found one, therefore concludes that they never use his troughs. Handling the captive armadillo is easy: you just grip it by its tail. But beware! Let your attention be momentarily diverted, and 'dillo will be off at a gallop, and when you catch up, is already disappearing underground.

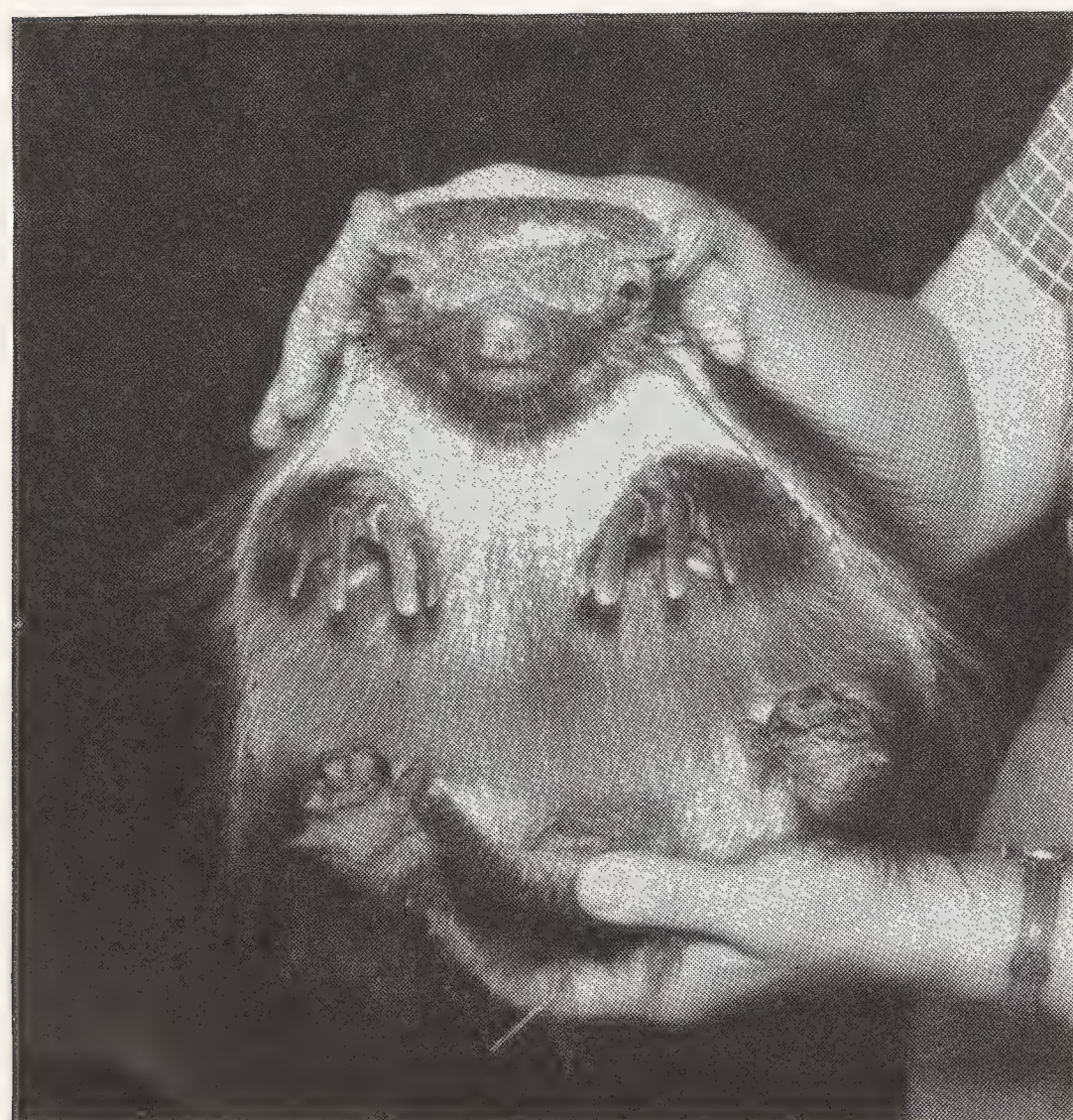
In August of 1961 "Aquila" and "Priscilla," declared by a *gaucho* to be the male and the female of the species, were brought to Buenos Aires, booked aboard the M.S. "Aragon" for England, and duly shipped. My companion and I had already discovered that an armadillo cage must have no wire, that 'dillos must be able to dig in order to be happy, that they need (surprisingly enough) plenty of fluid (milk preferred, brandy adored, water tolerated) and would live on a mixed diet of corn, cabbage leaves, grass and other greens, salt, etc., and, in particular, masses of raw meat. Their kennel was a simple wooden box, the lid opening upwards and having slats cut in it with a fretsaw. Inside, it was divided into a larger and a smaller room by a partition containing an opening. Sawdust was found to

be the ideal substance for their home, as it was easy to clean, light in weight and acceptable to the happy couple. They did not like pure sand, and garden soil, although acceptable to them, was not to us.

Aquila and Priscilla showed few of the inhibitions often exhibited by adult wild animals brought into captivity. Their primary needs of food and drink and a secure home providing for their digging propensities were easily met, and



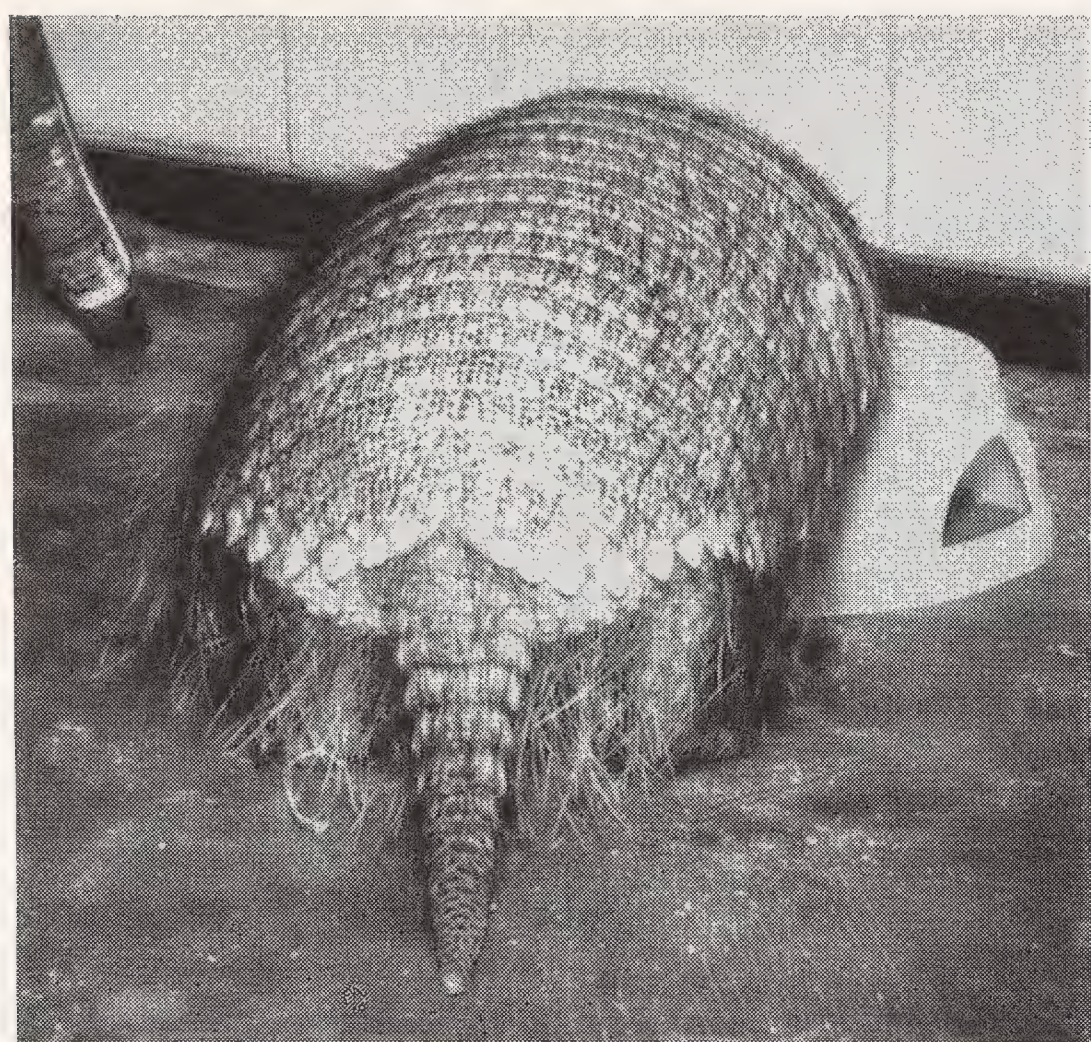
The armadillos were excellent jumpers — "Priscilla" could clear two feet at a leap — and it was not difficult for them to hook claws over an edge and heave their bodies over it.



"Aquila," the male of the pair of Hairy Armadillos the author took back to a British zoo, is held up to display the remarkably heavy development of its claws, and its furry belly.

soon, fat and prosperous, they became completely amenable to handling and display and became very popular travellers with passengers and crew alike until in due course they took up residence in a zoo.

It was during this intimate acquaintance with Aquila and Priscilla over two months, at frequent intervals of day and night, that we began to see the answers to some of the beliefs of the *gauchos* and *estancieros* about the habits of the Hairy Armadillo. We soon discovered that Priscilla and Aquila could do a vigorous jump straight over a wall. Priscilla could clear two feet at a leap. If the barrier was higher, she leaped up, gripped the edge with her gigantic claws, and heaved herself over, thinking nothing of tumbling on her armor-



The Hairy Armadillo is well-named, as this picture shows. In captivity, with plenty of appropriate food, they grew "shining tresses" and carapaces glistened like polished shoes.

plated head over the other side. Obviously an armadillo in a cattle trough would be capable of jumping out even with a vertical cement wall to negotiate. The couple loved water. They did not swim — just walked about on the bottom, under water. When excited, they snuffled and wuffled with wheezing noises, and always moved like advancing tanks, frequently colliding in daytime with solid objects, as their eyesight seemed limited. The teeth were peg-like but effective for chewing meat or grain. Meat would be held in the claws of the front feet, much as a dog holds a bone with its paws. They were rarely aggressive, but if annoyed Priscilla would occasionally put her head down and charge at the offender like a miniature rhinoceros, "humping" her armor-covered shoulders to strengthen the impact of the attack.

The carapace is divided into three parts: a triangular shield on the dorsal side of the head, the main body carapace with transverse jointed bands across its "waist," which vary in number from species to species, and the completely armored tail. The "armor" throughout consists of epidermal thickenings with hairs scattered freely in between. The belly is entirely covered with white, fairly soft, hairs.

As is common knowledge with animal collec-

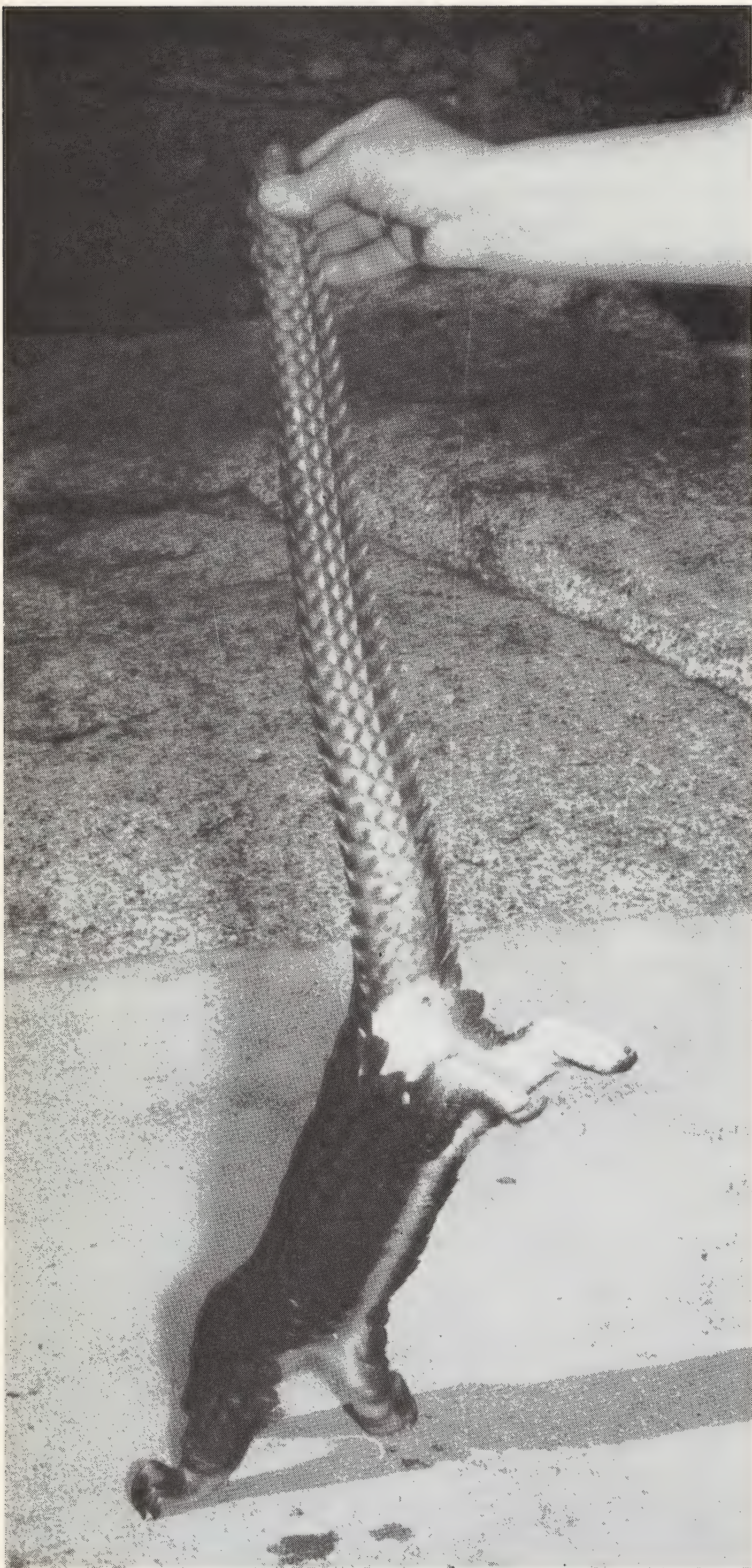
tors, any animal caught wild is often full of parasites, internal and external, and often scarred and "tatty." Priscilla and Aquila were no exception, but soon, with an improved diet as varied as possible, regular cleaning and plenty of fresh air and baths, their carapaces began to shine like polished shoes, and their hair to grow into shining tresses.

What about their natural life in the wilds? In spite of their being so common, I have found little detail about them in zoological literature. Little or nothing appears to have been written about their life inside their burrows, of any burrow-parasites or commensals; little is known of how they rear their young. They are known to be mainly nocturnal, but may also be seen in the pastures on sunny days. They are known to feed on grain, and to crop the pasture itself, as well as delighting in a meal of dead meat (fresh or decayed). Possibly they eat eggs, fledglings and field mice, and perhaps even snakes and lizards. I am quite certain from observations of the captive specimens that they not only drink water freely, but also bathe in it.

Can there be any relationship between these amusing armadillos of South America and our African pangolins? My personal acquaintance of pangolins is with the species *Manis tricuspis*, the White-bellied Pangolin, and unfortunately I can contribute no observations at present on its courtship.

Like the armadillos, *Manis* has a protective exoskeleton but, instead of the epidermal thickenings interspersed with hairs, the overlapping scales are made of modified hairs, hardened into leaf-like, overlapping units which extend from the nose to the tip of the tail. As in the case of the armadillo, the carapace edge is sharp and well able to inflict a severe wound on any intruder who may attack the animal's belly. The belly itself is covered (in *M. tricuspis*) with soft white hairs. As in the armadillos, the claws are greatly enlarged, in particular on the third digit of the fore-limbs, but unlike the armadillo *Manis* walks on a soft, fleshy pad just behind the claws. The claws appear to be used only for climbing and digging, particularly the digging out of ants from their nests in palm trees, etc.

Pangolins are remarkable as being the only mammals in Africa with a truly prehensile tail, and they frequently use it to hang, unnoticed,



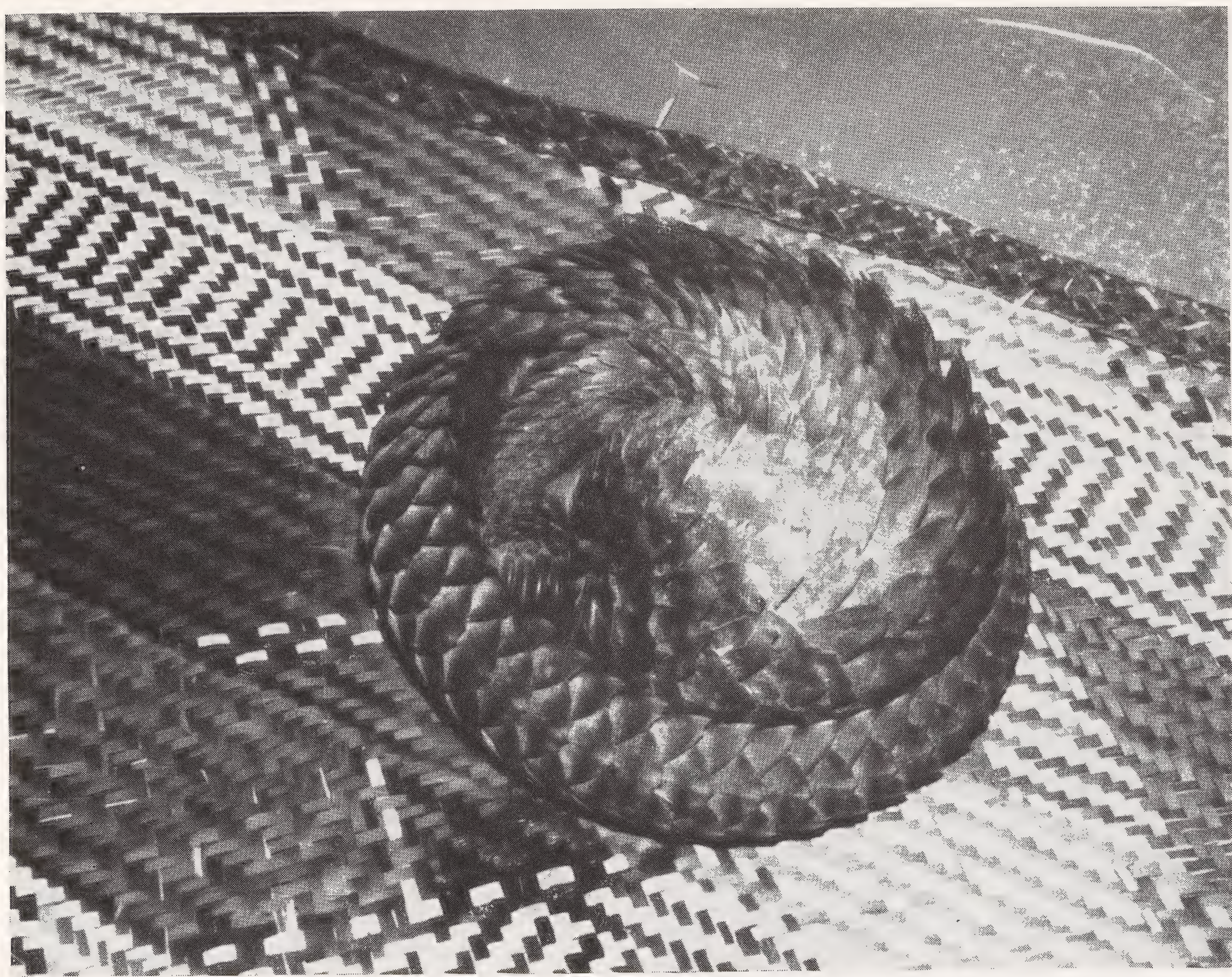
The tail of the White-bellied Pangolin, about twice as long as the body, has a sensitive pad at the tip. While the ventral surface of the body is hairy, that of the tail is well-scaled.

from the fronds of the palm trees, looking extraordinarily like a palm-fruit as they do so, for in that position the scales are inverted and resemble the upward-pointing scales on the palm itself. The very tip of the tail has a fleshy pad, (well supplied with tactile sensory nerve-endings) with which it grips any support.

Like the armadillo, the pangolin relies for its main defence on rolling into a ball, thus concealing its unprotected areas. If startled on the ground, however, it rolls up so vigorously that it throws itself head over heels along the ground, rolling to a spot as much as four feet distant. If it rolls among dead leaves or grasses, it seems to lose its identity at once and disappears so effectively that one seems tricked by one's own eyesight! If startled on a tree, however, it does not roll up but with remarkable agility dodges to the opposite side, where it "freezes," blending astonishingly with the true bark. Any attempt to pull it off is met with the most effective resistance, as claws and tail grip the tree trunk or branch. Any attempt to lift it by hand will be met with a sawing action on the side scales into the flesh of the hand, or even into a thick glove.

The natural food of the tricuspid pangolin is said to be the tree ants which frequent palm trees, and it is said that they will take neither termites nor other species of ants. In the Kagarko District of Northern Nigeria, I found on one occasion three termite nests torn open, and the unmistakable spoor of a pangolin nearby. It was impossible, however, to be certain whether this was the work of *M. tricuspis* or of another species. With pangolins in captivity, however, my success has been with one, diet, and one only: three eggs lightly scrambled per evening, flavored with 5% formic acid solution, and water to drink. All offerings of other foods, unflavored or flavored with formic acid, have been ignored.* The long cylindrical tongue, up to ten inches long, is mainly reddish in color, with a bluish tip, definitely sticky and very muscular throughout its length. When feeding, the food and water are taken entirely on the tongue, there being no teeth, and only a very slight movement of the lower jaw is possible.

* The Zoological Park's experience with Pangolin diet has been quite different. For years we have used the standard diet of milk, finely-ground meat and lightly coddled egg, with no formic acid added.



Unlikely as it may seem in an animal with so limited a brain, the pangolin may be tamed and come to its food at a recognized signal, *e.g.* the opening of the door of its cage. It may become used to handling and entirely lose its tendency to hiss (a sound quite indistinguishable from the hiss of a snake) or to roll up when touched or startled.

The pangolin is normally entirely nocturnal, but those kept in captivity may come out even in the daytime. Otherwise they sleep all day, curled in a tight ball, or suspended from a branch. I have seen a tame one sleep full-length flat on its back, claws in the air, on a hot day, exactly as does the armadillo.

There seem to be so many similarities in adaptation to environment between the armadillos and the pangolins, and yet an examination of the internal structure leaves one in little doubt that the similarities are entirely superficial. My purpose here, however, is not to deal with the internal anatomy of either the armadillo or the

A pangolin at rest. When it is curled up in a tight ball — asleep or defensively — the pangolin has a tight defense; in the act of curling on the ground, it may roll for several feet.

pangolin (reference to text-books on zoology provides such detail), but rather to contribute to the scanty knowledge available on their actual mode of life. From the little that is known of their anatomy, habits and distribution, one is forced to the conclusion that, although the true armadillos and the pangolins have so many similarities, they are phylogenetically unrelated, and the two Orders containing them, the Edentata and the Pholidota, must not be regarded as connected. The temptation to call the pangolin or "scaly ant-eater" an "armadillo" must be resisted at all costs, but whatever the name, there is no doubt at all that there is room for much more observation of the natural life of both groups of animals, and in particular of their courtship, home-building and the rearing of young in the wild state.

Report from Simla:

Hummingbirds, Poinsettias and the Buzzing of Leaf-Cutting Bees

By JOCELYN CRANE

Director, Department of Tropical Research

CONTINUING the practice of Dr. William Beebe, who several times a year sent a newsletter from our Trinidad research station to the Trustees of the Zoological Society, Director Jocelyn Crane has reported some of the current happenings at the William Beebe Tropical Research Laboratory, as the "Simla" station has been named. Since Dr. Beebe's death last year, the station has been almost continuously occupied as a base for staff and visiting scientists — ED.

SIMLA is one of those places where people are good at doing things that don't need doing anywhere else. For instance, we have just learned how to rescue hummingbirds, keep poinsettias from wilting and recognize leaf-cutting bees by their buzz.

Simla's Leaf-cutting Bees. Professor Theodore Mitchell taught us about the buzzes. He knows more about megachilids, the leaf-cutting bees, than anyone else in the world. After writing two volumes on northern bees he is now hard at work bringing order to the evolutionary burst of leaf-cutters thriving in the tropics.

The genus *Megachile*, as Dr. Mitchell explains, is a large group of solitary bees which nest in cavities or in the ground. They construct cells of leaf fragments which they cut with their sharp jaws. Each cell is stocked with pollen and nectar,

and an egg is laid in it. It is then sealed with a green cap and another cell fashioned on top of it, until there is a long row of delicate chambers, the architecture varying with the species.

Right now, Dr. Mitchell's chief concern is to become familiar with our many local species which are all both scattered and wary. Fortunately, he knows the patterns of their flight and the pitch of their buzz so well that he rarely confuses them with other bees. This morning I watched, looking over the wall, as he stopped at a patch of yellow bloom. He bent his head, listening, and stayed motionless for five minutes. All about him bees buzzed, unmolested. Then, suddenly, there was a lightning sweep of the net and that, for *Megachile*, was that.

Construction and Maintenance. Trinidad's winter is in most parts of the island a time of brown hills, bush fires and burned sugar cane. Up our valley, however, the forest and cocoa stay green, while white cyp, scarlet immortelles and yellow poui shower color down the slopes.

More practically, it is a time to get things mended and other things built, with no fear of downpours or roofless rooms or lost days of rain-soaked work. Accordingly, in the winter drought, we have replaced the termite-ridden supports of the roof of the photographic laboratory, and are now in the midst of building twin insectaries. Long and high, they are needed next summer for controlled experiments in social behavior. They are copies of a decayed preceding structure, except that each will boast a catwalk halfway up. There, in lofty glory, Dr. and Mrs. Brower and I can watch butterflies at eye-level and coax down ailing specimens clinging high on the gable.

We have also started work on a temperature-and-humidity-controlled growth chamber, for use in several kinds of insect study. In addition, Dr. Donald Griffin's "battery" of two seasons ago, having done a stint as shelter for Dr. Brower's birds, is now reverting to the bats, in preparation for Dr. Griffin's arrival in spring. Meanwhile, the birds, for continued mimicry experiments, are awaiting completion of new quarters, including a flight cage, farther along the trail. Finally, the crabberies are being overhauled before a hoped-for shipment of fiddlers from Hong Kong and Okinawa.

This has also been the season for arranging the

hummingbird rescue system, mentioned above. Every year at Simla we have worried about hummers, which often swoop into the laboratory through the open northern end. Until recently they used to bump in confusion against the triple-height ceiling. Sometimes we attracted them out by putting red hibiscus on the floor by the door, or caught them with a butterfly net on a 15-foot pole. The flowers rarely worked and the unwieldy net was often equally hard on both bird and rescuer.

Now we have the solution. A small section of roof at the ridgepole has been replaced with a trap-door of transparent plastic. And the Hummers' Escape Hatch works perfectly.

Visitors. During the rainy summertime Simla is full of university people who can only then leave classrooms for tropical research. We remember with a kind of relieved nostalgia Dr. Theodosius Dobzhansky's materials and methods, since he used vast quantities of a repulsive concoction made from yeast and ripest bananas. Thereby he attracted legions of very special fruit-flies. These he needed, alive, from Simla as part of his far-flung study on the evolution of certain groups of species. The flies were placed in jars, insulated against cold and flown north, their routing and reception planned with the care accorded to traveling royalty.

The Social Importance of Height. Tomorrow Carnival starts. For weeks the backyards of Trinidad have been rehearsal halls for Steel Bands, the musicians using the famed instruments made from empty oil drums. At dawn the drums with their easy rhythms will be on the streets, sounding far more tuneful than either "steel" or "drum" would lead a stranger to believe. People dress up all ways, in all colors; they represent everybody from Sitting Bull to the Queen of the Hottentots. Many have headdresses so high the proud wearers must have help in holding them aloft. As usual, Carnival not only gives us pleasure, but presents some fine scientific comparisons.

One of these concerns the social value of temporary height. It is one of those good zoological principles which has been unconsciously followed by humans through history. Last month I saw an archbishop's chair in an ancient church in Cyprus; just a bit lower was the bishop's seat. A few days later, in Frankfurt, the head table at a

civic dinner was on a dais. I wondered whether either the reverend fathers or the burgomasters knew that their status trappings go far back in the animal kingdom — and forward even to the carnival revellers in Trinidad.

This week at Simla we have seen a katydid threaten a lizard by raising on tip-toe and lifting on high her green and orange wings. We have watched a small silky anteater face his captors, rear in the air on his hind legs, and stretch to his ultimate reach. Finally, in the crabberly a fiddler from western Costa Rica displayed for the first time, jerking his great red claw straight overhead and tripling his height.

That crab's display was a triumph for the crabberly. We waited for it eighteen months, while the crab grew up. I have never seen the species wave in the wild, and was thankful to photograph it promptly. It was as important as the first record of a new bird song.

An incidental result was that another species, which came last year from the Philippines, promptly waved in answering threat. He too is a jerker, but his claw, in waving, never reaches above his eyes. For a moment the two crabs confronted each other, the Costa Rican and the Filipino, like sailors squaring off in a bar. Then the low-reaching crab gave way and ambled back to his burrow.

How to Pick a Poinsettia. Another bit of recent knowledge came from a Chinese friend. She taught us how to keep our poinsettias from wilting on the dinner table. We had tried all earlier suggestions without success. The trick that works is to plunge the just-cut stems at dawn into truly boiling water.

At Simla that means to race down the front steps at 5:30, carrying a knife, a pail of cold water and a kettle still at the boil. In quick succession you cut the stems to their perfect final lengths, tilt them swiftly to save the sap, slide them into the kettle, whip them out two minutes later, and thrust the lot deep in the pail of cold water. Afterwards, the morning seems peaceful and breakfast tastes wonderful. And, if everything has gone well, the flaming blooms will last for days.

We hear that all this early morning pother is needless in the north. Well, Trinidad always has been special.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

Our Galapagos Tortoises Home from Florida

Six years ago we farmed out three of the largest of our Galapagos Tortoises to the Crandon Park Zoo in Miami, where we thought they would thrive under optimum conditions of sunshine and warmth. One subsequently died, but the remaining two did thrive beyond our expectations, so that the largest attained a weight of 440 pounds, a gain of 150 pounds in the six years.

The two survivors were brought back to us this spring by Head Keeper of Reptiles Stephen Spencook and will be exhibited in the new Galapagos area south of the Great Apes House. We have excellent winter quarters for them in the greenhouse at the Farm-in-the-Zoo and they should thrive as well as in Florida.

Their return brings our collection of Galapagos forms to five and we now have pairs from northern and southern Isabela, Santa Cruz, Duncan and San Cristobal. These animals face extinction in their native islands and our captive specimens probably represent the only chance of survival for at least the San Cristobal and Duncan races. Unfortunately, although some zoological parks have much larger herds of these tortoises, most of them are not identifiable as to race and any young obtained are likely to be of mixed parentage.

Design Specialist Appointed For Zoological Park

Jerry Johnson has been appointed Exhibit Specialist on the staff of the Zoological Park. He will work with the Director and department heads in the design and construction of graphic educational and exhibit displays.

Mr. Johnson is a graduate in applied arts of Auburn University of Auburn, Alabama, and has had considerable experience in types of design allied with the Zoological Park work.

South African Spring-haas in the Collection Again

It has been more than forty years since we exhibited the Spring-haas, or African Jumping "Hare," but it is a sufficiently grotesque creature to justify it as a permanent member of the Zoo family.

It is widely distributed over the higher and drier parts of South Africa, both on the plains and in mountainous country. In the wild it feeds mostly in the twilight or at night, coming out of its complex burrows where several families live together. Descriptions of its habits in the wild say it can make tremendous, kangaroo-like leaps, and that it makes better speed going up-hill than down, although it is never very fast and can be run down. One way of getting it out of its burrow is said to be to pour water down the hole, whereupon Spring-haas promptly pops out. It has the unfortunate habit of being fond of cultivated plants — but on the other hand, it is very good eating, itself.

IN BRIEF

Parking Fees. Parking fees for the four fields in the Zoo have been increased on Saturdays, Sundays and holidays from 50 cents for automobiles to 75 cents, and from \$1.00 to \$1.50 for buses. Parking is free to Members.

"Zoo Trains." The New Haven Railroad again this spring ran a series of four "Zoo Trains" at special fares from the New England area to the Bronx Zoo.

"Dunes" at the Aquarium. The Long Island "Dunes" exhibit at the New York Aquarium, begun two years ago, made a good showing with the plants available. Beach plums and bayberries bore fruit in profusion but the exhibit could not be completed because many native plants no longer exist in the wild, apparently. Those few

which are in private gardens are jealously guarded. Through the good offices of Mr. Sidney Shapiro, Chief Engineer and General Manager of the Long Island State Park Commission, Mr. Henry Reppa, Landscape Consultant of Wading River, procured 21 species for the Aquarium which were planted this spring. The "Dunes" will soon look much as they were 200 years ago.

Baby Season. Early spring births and hatchings in the Zoological Park are running about on schedule. We have a baby Mandrill, a female Bison calf, a Small Malayan Mouse Deer and a good hatch from killdeer, waterfowl, partridge, pheasant and other eggs laid in the collection.

A Rare Tortoise. A specimen of the Yellow-

headed Tortoise from southeast Asia, *Geochelone elongata*, has been acquired by the Reptile Department. It brings our collection to 15 species.

Creep. There is considerable disparity in size between the big Père David's Deer and the diminutive Chinese Water Deer that share their range on the west side of the Zoological Park—so much so that sometimes the water deer are disturbed by their big associates. All that has been changed by a "creep" constructed this spring at the north end of the range. A shrub section has been fenced off, with a two-foot gap in the bottom of the fence so the Chinese Water Deer can run underneath to shelter while the large deer are held back.



Two female Spring-haas, the first we have exhibited since 1922, have been installed in a large compartment with a colony of Flying Squirrels in the Red Light Room of the Small Mammal House. The two animals adjusted quickly to the reversal of their activity from night to daytime.

PUBLICATIONS OF INTEREST

SIMBA: THE LIFE OF THE LION. By C. A. W. Guggisberg. 309 pp., many photographs. Chilton Books, Philadelphia & New York, 1963. \$6.50.

Dr. Guggisberg, attached to a laboratory in Nairobi, has studied and photographed lions in the field for 25 years. No matter what you want to know about lions, you are likely to find it here. Good for reference, and for sheer reading enjoyment.

THE NATURAL HISTORY LIBRARY

SNAKES IN FACT AND FICTION. By James A. Oliver. 214 pp., 18 photographs. \$1.25.

BACK OF HISTORY. By William Howells. 384 pp., maps and drawings. \$1.45.

A GUIDE TO BIRD WATCHING. By Joseph J. Hickey. 295 pp. \$1.25.

Latest additions to the inexpensive, paperback reprints being published by Doubleday Anchor Books in cooperation with the American Museum of Natural History. "Snakes in Fact and Fiction" was originally published while Dr. Oliver was Curator of Reptiles at the New York Zoological Park, and many of the illustrations are from our photographic collection.

THE WILD MAMMALS OF UGANDA. By R. M. Bere. Illustrated by Ruth Yudelowitz. xii + 148 pp. Longmans, London, 1962.

ANIMALS OF EAST AFRICA. Written and illustrated by C. T. Astley Maberly. 221 pp. Howard Timmins, Cape Town, 1962. 15 shillings.

These two excellent little books, popular introductions to the mammals of East Africa, provide two more welcome pieces for the jig-saw puzzle that is Africa's fauna. There is, understandably, heavy emphasis upon the large game species, but a representative selection of the smaller mammals is also presented in each book. The illustrations by Mr. Astley Maberly are excellent, both for field identification and as portraits. — J.A.D.

LIFE HISTORIES OF NORTH AMERICAN BIRDS OF PREY. Two volumes, Parts 1 & 2. By Arthur Cleveland Bent. 409 and 482 pp., photographs. Facsimile reprint, Dover Publications, New York, 1963. \$2.35 each volume.

"Bent's Life Histories" need no introduction to ornithologists and a simple announcement that this

facsimile edition of the original Bulletins of the Smithsonian Institution is available should bring joy to many who could not find the out-of-print originals, or found them prohibitively expensive. The type page of the reprints is only a quarter of an inch narrower than the original, and while the illustrations lose a little in reproduction, the loss is not important. Bent's Wild Fowl, Shore Birds, Gallinaceous Birds and Gulls & Terns have already been issued, and other volumes in the complete Bent series will follow.

THE ECOLOGY OF FISHES. By G. V. Nikolsky, Department of Ichthyology, Biology-soil Faculty, Moscow State University. Translated from the Russian by L. Birkett. i-xv + 352 pp. Academic Press, New York, 1963. \$12.00.

This is another of a series of recent translations of Russian books on fishes, fish parasites and diseases and fishery biology in general. As stated by the author, "This book represents a brief essay on the ecology of fishes." It is well-written and the subject matter deals with interrelations between fishes and their abiotic and biotic environment, life cycles and the biological basis for a rational fishery. Recommended for students wishing to specialize in fishery biology. — R.F.N.

ANIMAL HORMONES. A COMPARATIVE SURVEY. PART I—KINETIC AND METABOLIC HORMONES. By Penelope M. Jenkin. xv + 310 pp., 1 color plate, 77 figs. Pergamon Press, New York. \$7.50.

People used to think of hormones as those mysterious chemical messengers in the blood responsible for all sorts of actions and reactions in animals. That popular definition still holds true except that scientific study has removed most of the mystery, as this detailed but well organized review amply demonstrates.

THE STUDY OF FISHES MADE SIMPLE. By Eugene V. Mohr. 159 pp., 108 figs. Doubleday & Co., Inc., Garden City, 1962. \$1.45.

This paperback would have filled the need for a reasonably priced, popular approach to the study of Ichthyology, aimed at the beginner and providing him with practical suggestions as to how he can further his interest in fish, were it not marred by entirely too many gross errors. (I noted 74 in a reading that left many fine points unchecked). It is hard to excuse author and publisher for not obtaining the expert advice that would have prevented the spoiling of what might have been a most useful book. — J. W. Arz.

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THE MAGAZINE OF THE NEW YORK ZOOLOGICAL SOCIETY

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ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

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A Common Front for Wildlife Protection

CONGRATULATIONS TO OUR SISTER-INSTITUTION, the National Audubon Society, for its recent strong public statement decrying the use of leopard skins as women's coats. Although the Audubon Society is primarily dedicated to birdlife, their action in the leopard skin matter illustrates the truism that all forms of animal life are interrelated and, more specifically, that every organization concerned with wild animals of any kind needs to wage a battle for the preservation of all forms of wildlife.

The above episode is reminiscent of a somewhat similar one that occurred some fifty years ago. At that time it became stylish for women's hats to be adorned by the feathers of rare and exotic forms of birdlife — including Birds of Paradise. Our Society fought side by side with the Audubon organization in combatting these practices. These joint efforts, supplemented by those of others interested in wildlife preservation, resulted in new provisions in the Tariff Act that prohibited the importation of birds or their plumage for use in the millinery trade.

If the misuse of wild animals, such as the leopard skin situation, continues it would be imperative to take similar action in the case of a number of species of animals whose existence in the wild state is now so critically threatened.

Fairfield Osborn

SMITHSONIAN
INSTITUTION

AUG 12 1963

The Aquarium Knows How To Keep Them

COOL

By CHRISTOPHER W. COATES

Director, New York Aquarium

LIVING in very cold seawater is a wealth of aquatic fauna of an enormous variety of shape and color. Much of this is of great scientific interest and all of it prime exhibition material. Vertebrates and invertebrates are included, and except for a few small aquarium exhibits in the immediate vicinity of the homes of these biological treasures, they are never shown and the whole fauna is largely unknown to the mass of aquarium visitors.

Our Pacific Northwest is particularly rich in these odd animals which live at temperatures usually below fifty degrees, and although many of them may be collected with comparative ease, especially since the development of scuba diving, no aquariums on the eastern seaboard and few on the west ever have any of them. Where good cold seawater may be pumped into the tanks and allowed to run back to the sea, it is possible to show these creatures, but it has been practically impossible to move them even a few miles from their native waters.

There are two reasons for this. One has been the difficulty in transporting fishes of any kind over long distances under controlled temperatures, and the other the great difficulty in keeping water very cold without interfering with its other properties.

Transportation techniques have developed enormously during the last eight or ten years, and it is now possible, by the use of tranquilizers and chemicals which bind the suffocating carbon dioxide released by the fishes and other animals, to ship fishes in little more water than is necessary to keep them wet. Plastic bags which can be completely sealed around an atmosphere of oxygen

when needed also help, and modern plastic shipping boxes will keep the temperature of the enclosed creatures without change for hours on end. These factors, combined with jet aircraft, have made it possible to ship aquatic creatures we never thought could ever be moved from their native waters alive.

However, the improvement in shipping techniques does not remove the other difficulty, that of keeping water cold. We have long learned how to keep small tanks at any degree of temperature we like, for heating is much easier than cooling, for one thing, and small heating units enclosed in inert glass are a commonplace. Heating or cooling water in large quantities is something else again, even though it is still easier to heat than to cool.

Up to now almost all our experience has been in keeping warm seawater creatures, and we have developed a number of techniques for keeping the water warm. However, they all use metal to some extent, and almost all metals, in fact *all* metals, are soluble in seawater to a greater or lesser degree, and most metals in solution are quite toxic to fishes. After much trial and effort we had found that block tin coils through which hot water or even live steam could be passed, worked very well at the old Aquarium at the Battery. Some coils we had used for twenty years were just as bright and clean as when we first installed them. There was never any trouble with them or with the fishes kept in the systems in which they were working. Consequently we had no qualms whatever in specifying block tin, which is pure tin, for the heaters at the new Aquarium. These were installed, but after several months we found

odd things happening to the waters in the various systems. Instead of increasing in density with age, as they should, they were remaining at the same density or even becoming less dense, and there were other, less tangible effects. These were all traced down and we found that our prized block tin coils were becoming pervious and allowing hot fresh water to escape into the salt water systems. How or why this should happen baffled us, the manufacturers, and even the Tin Institute with which we conferred.

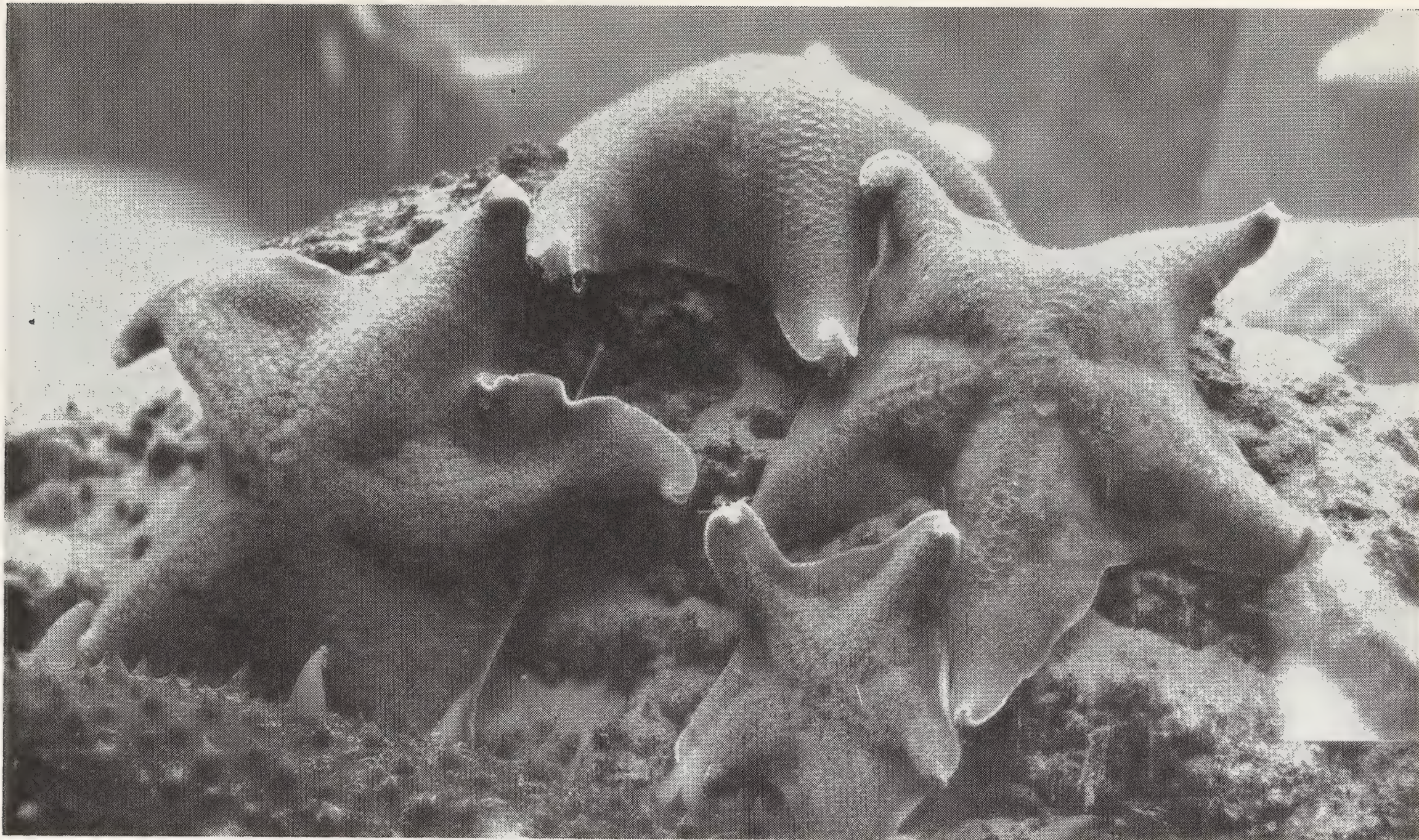
We eventually found what was happening: the seawater we were taking from the sea had infinitesimal quantities of iron in a colloidal state. This of itself would do no harm, but the constant friction set up in the water as it passed through the non-metallic pipes of the various systems was floccing the iron, which would settle in microscopic fragments on the tin heating coils. The two

different metals set up minute electrolytic cells which in turn ate away the tin. The resulting holes were of the tiniest size, but there were enough of them to cause the difficulties we were encountering in the seawater systems.

We tried a great many ways of protecting the tin, for it is virtually impossible without a complex and expensive plant to remove the iron, but everything failed. We tried other substances, iron, concrete, glass, but all either broke down chemically or mechanically or were inefficient conductors of heat. (The prime need of a heat exchanger is, of course, its ability to pass heat quickly. The plastic and hard rubber pipes we

One of the most impressive of the cold-water exhibits at the Aquarium is the Smooth Tealia Anemone, *Tealia crassicornis*, from the Pacific northwest. It is approximately 10 inches high and 10 inches thick.





use to carry the water are all inert, but do not pass heat, so they cannot be used as heat exchangers).

Eventually we found a heat exchanger made of carbon. This is inert and was reputed to be efficient. We gingerly inserted one in a trial water system. It worked. No trouble, no leaks, no effects on even the most sensitive animals, so we started putting these heaters in all our water systems. (An aquarium such as ours has many different systems, varying in density, temperature, treatment for control of parasites, and even because the waste products of one kind of fish are toxic to another kind of fish).

To come back to our cold water animals. We thought it possible that these new carbon heaters would work in reverse, that is, extract heat from the water. The manufacturers thought so too, and also that they would take some increase in pressure, as we must develop when we are pumping water; so we cautiously set up a trial cooler system. It did work very well, except that we did not make it large enough to extract the additional heat the water picks up as it passes through the exhibition tanks. This only required a change in size, which we are doing now.

The cooling apparatus is now working in our cold water system which carries seven exhibition tanks and two reserve tanks. Moreover, by a Rube Goldberg arrangement of plumbing, we

To anyone familiar with the common starfish of this area, the Red Web Starfish (*Patiria min-iata*) of the Pacific northwest are giants indeed. These specimens are 6 to 8 inches across.

have established three different temperatures within the same system, with some tanks running as cold as thirty-five degrees, some at forty-five degrees, and still others at fifty plus, all to meet the requirements of our new coldwater exhibits.

These consist of a great variety of enormous starfishes, some with as many as twenty-five arms, two-foot-high anemones, sea cucumbers, five-foot-long wolf eels, Surf Perch, octopus, and a number of our own local fishes. We even had two five-foot King Crabs from Alaska, but unfortunately one of these stepped on a Giant Starfish, which immediately released its poison. This killed both crabs within a few minutes. (We had to keep the crabs and starfish in the same tank because they both required water not above thirty-six degrees). As our cold water system develops we will be able to increase the collection of odd, strange and lovely cold water animals, and concentrate on the next problem these cold water tanks establish — that of condensation on the glass, for which there is presently no commercial solution for fish tanks.

Safari to the Tsavo

By ROYAL LITTLE

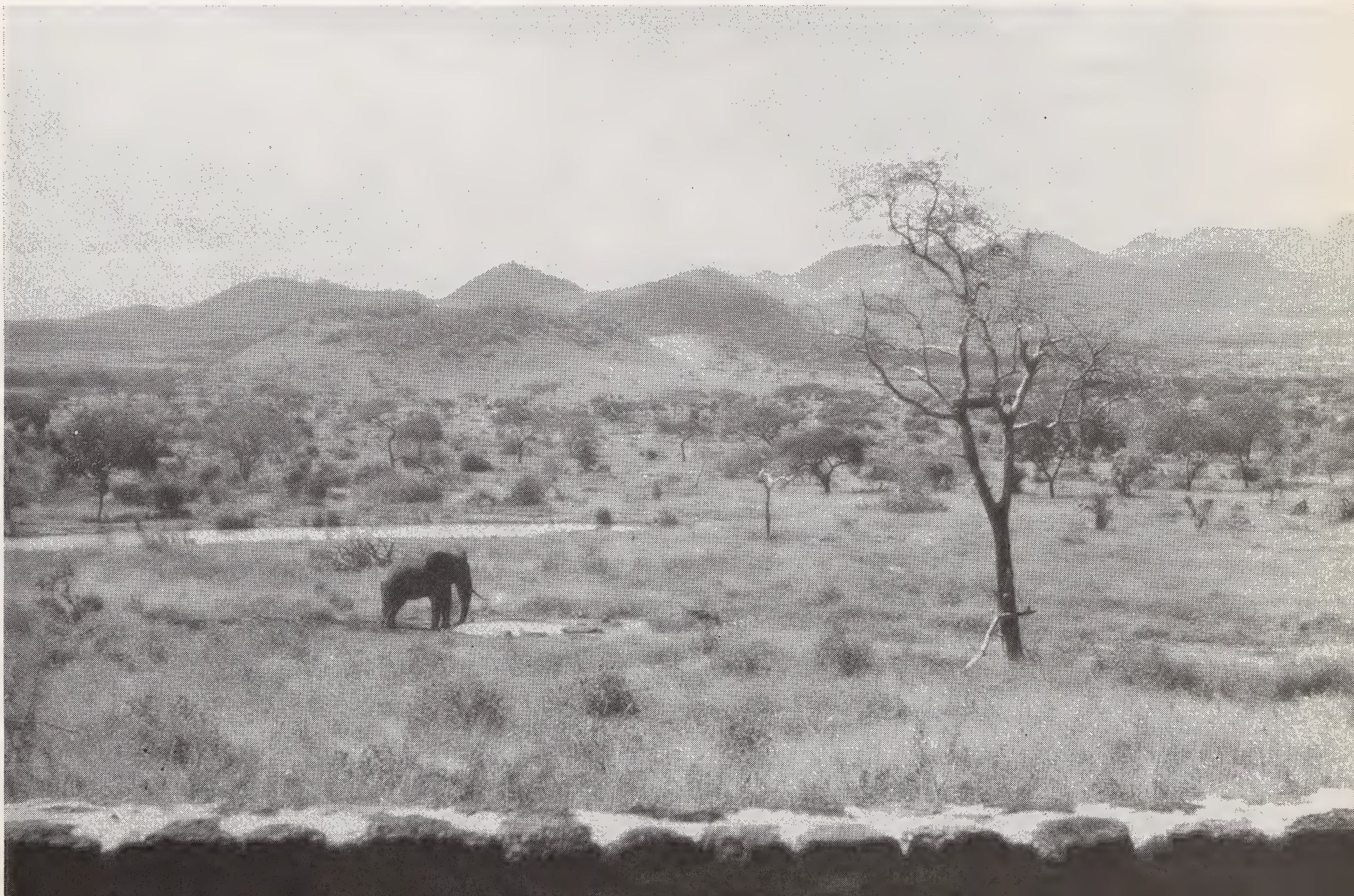
*Benefactor Member of the Zoological Society,
furthering the Society's African Wildlife interests*

This is the second article by one of our members concerning wildlife conditions in East Africa. It highlights some of the problems involved in the management of a National Park over there, in this case the famed Tsavo National Park in Kenya. Also, it indicates some of the ways in which the New York Zoological Society, through its African Wild Life Fund, is helping to relieve the crisis facing the wild animals of that continent. Other activities of our Society in this urgent situation are directed towards field research in order to produce information useful to wild animal management and protection and, of large importance, the educational programs which the Society is supporting in order to create understanding among the African people of the great values — including income from tourism — of their unique heritage.
— FAIRFIELD OSBORN.

THE NEW YORK ZOOLOGICAL SOCIETY, among its other programs in Africa, is assisting with some of the problems of Kenya's Tsavo National Park. With over 8,000 square miles (more than eight times the size of Rhode Island), this Park contains a wide variety of wildlife and provides some of the most beautiful scenery in East Africa. The Nairobi-Mombasa highway and railroad passing through the area divide Tsavo into two sections — Tsavo West and Tsavo East, each with its separate administration reporting to Col. Mervyn Cowie, Director of Kenya's Royal National Parks, in Nairobi.

From the verandah of Kilaguni Lodge in Tsavo National Park the visitor may watch elephants coming for a drink and a bath in the pool 200 yards away. The Lodge is new and is sold out for months ahead.

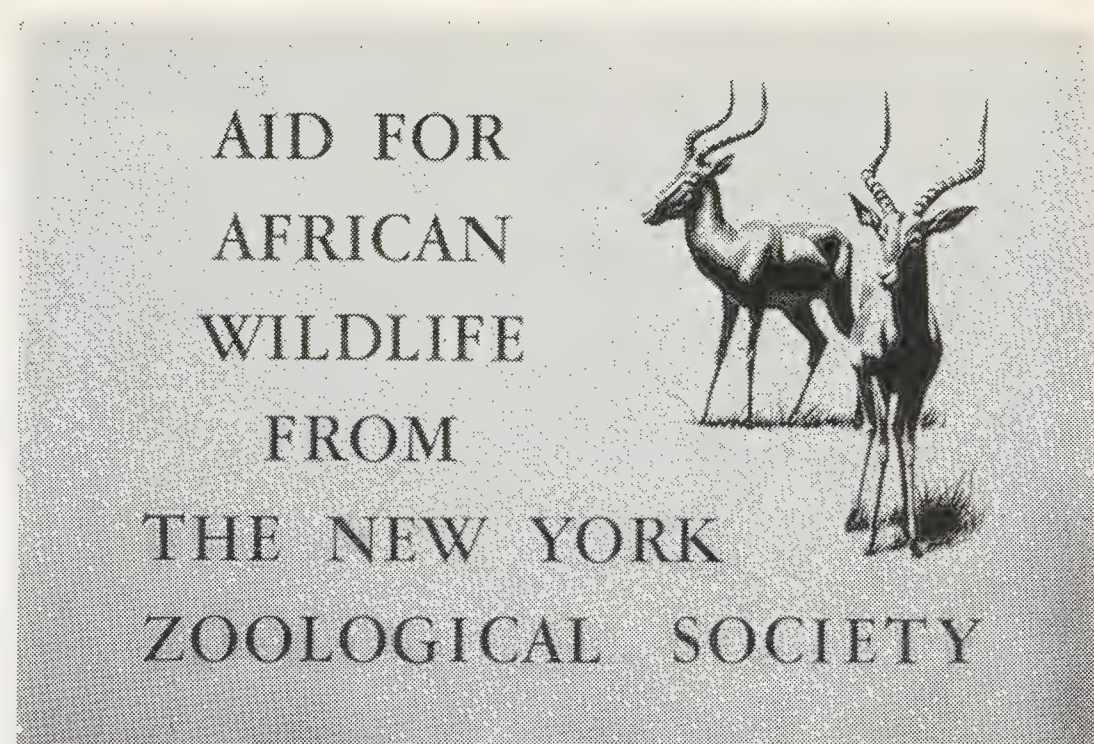
Helen S. Buckley Photo



In the West, except at Mzima Springs and along the Tsavo River, water is scarce. The Society has therefore participated in financing boreholes and catchments in Rhino Valley where grass is plentiful and where many more animals could be supported with adequate water supplies.

In the East, the huge herds of elephants create special problems. For example, during the height of the 1961 drought, an aerial survey showed over 15,600 elephants in the park and adjoining areas, and investigation on the ground indicated that trees were being pushed over at an alarming rate. This huge concentration was destroying the habitat upon which it and other animals are dependent and it appeared that something drastic would have to be done. One unrealistic plan was to "crop" more than a thousand animals in order to relieve the pressure. The assumption by uninformed observers that this should be done created confusion throughout the world. Why should elephants in an East African national park have to be killed when the general public thought there was a possibility of their being faced with extinction? Wildlife management experts, conservationists and animal lovers entered the debate. The advice received was decidedly mixed. Col. Cowie and his Parks Board of Trustees voted to obtain more information and postpone final decision until the summer of 1963.

With this background our safari group knew that the Society would be interested in receiving observations on these two phases of Tsavo's operations — water and elephants. We chartered two light aircraft and flew from Nairobi to Mtito Andei where we were met at the airstrip by Tsavo West's Chief Warden, Tuffy Marshall, and his two assistants, Ronald Jolly and Johnny Nesbitt. After checking in at the local hotel, we were driven by Land Rovers to Rhino Valley where we inspected the four boreholes partly financed by the Society, and investigated the fifth location for which \$6,000 is still needed. Each installation consists of a well, some as deep as 300 feet, a pump driven by a diesel engine, a large storage tank and an automatic gravity feed to a concrete drinking pool. Tracks and droppings indicate that elephants, rhinos, impalas and other game were already using these resources. Where applicable, boreholes will be marked with an attractive sign indicating the Society's assistance.



To mark the Zoological Society's participation in water-for-the-animals projects, as well as various others, these signs have been created on anodized aluminum, 18 inches by 12 inches.

Tsavo National Park has a popular new tourist facility, Kilaguni Lodge, which was sold out for months ahead. It is being expanded to accommodate over 60 guests. This is just the type of operation which will be needed in far greater numbers to handle the future influx of visitors to East Africa from Europe and America. The rooms are comfortable, with private baths. The dining room is excellent and the view, with Mt. Kilimanjaro in the background, is superb. While we were sitting on the terrace, an elephant ambled into view and went for a drink and a bath at the pool about 200 yards in front of the Lodge. After lunch we were driven in Land Rovers to Mzima Springs to see the hippos and crocodiles in the crystal clear water which pours out under the end of an ancient lava flow. Incidentally, the city of Mombasa pipes water some 150 miles from Mzima from a concealed point upstream from the hippos. Later in the afternoon we drove along the Tsavo River and saw many species of wildlife. In Tsavo West one can see elephants, rhinos, giraffes, waterbucks, zebras, gerenuks, dik-diks, oryxes, impalas, kongonis, buffaloes, elands, lesser kudus, baboons, vervet and Sykes' monkeys, lions, leopards, hyenas, jackals, wart hogs, ostriches, mongooses, ground squirrels and smaller mammals, and many varieties of birds. So-called plains game does not inhabit this section of the Park — the grass grows too high and provides too good cover for the predators.

After a good night's rest at the Mtito Andei

Hotel we were up early for our flight to Voi, the headquarters of Tsavo East, to meet Chief Warden David Sheldrick and his assistants, Dennis Kearny and Peter Jenkins, and take them for an airplane trip over their park to make an elephant count. This was to be the most exciting part of our safari. During extreme drought conditions as many as 1,000 elephants had been seen in a single herd and we hoped that in spite of recent heavy rains and excellent feed and water we would see some unusually large concentrations. After visiting David Sheldrick's lovely home and photographing his tame elephant, and the rhino and buffalo that graze on his lawn — the most fantastic assortment of pets we had ever seen — we took to the air. As we gained altitude we had an excellent view of Voi — everything neat, clean and well-painted, one of the best-maintained park headquarters in East Africa.

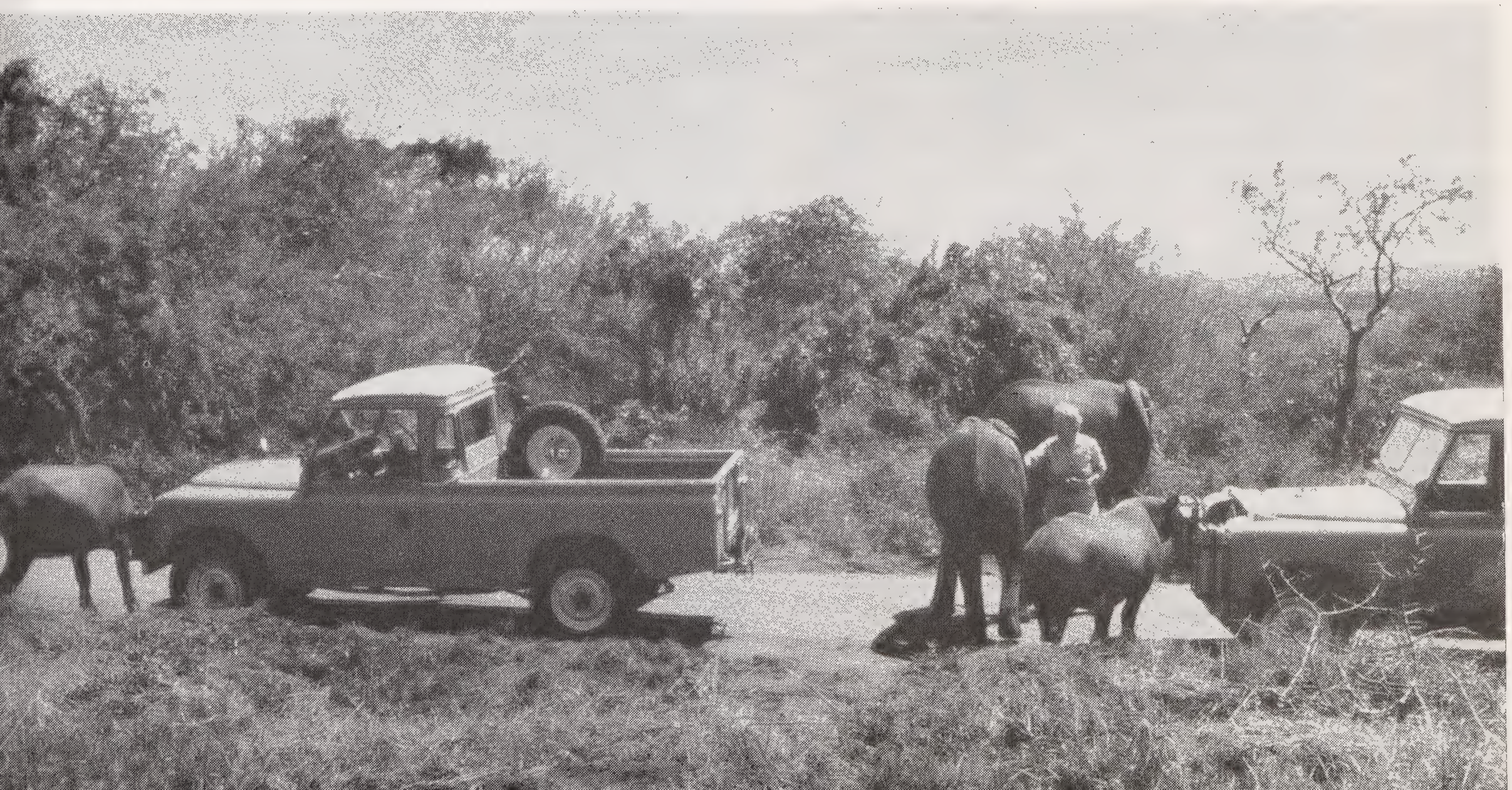
We headed east at low altitude to count and photograph animals but it soon became evident that the herds were well dispersed. Numerous natural catchments were full of water, with small groups of buffalo and elephant at each one. We circled over Aruba Lodge, a tourist attraction on a large artificial lake, but found only a few animals. Under drought conditions this lake is normally the focal point for hundreds of elephants. Turning north we flew over the Yatta Plateau which rises some 500 feet above the Athi River to its west. On this flat area, much of it covered with trees, were many natural rain catchments and wildlife was abundant and constantly in view — rhinos, giraffes and elephants (up to fifty at a time). Later we flew over Ithumba, the northern headquarters of Tsavo

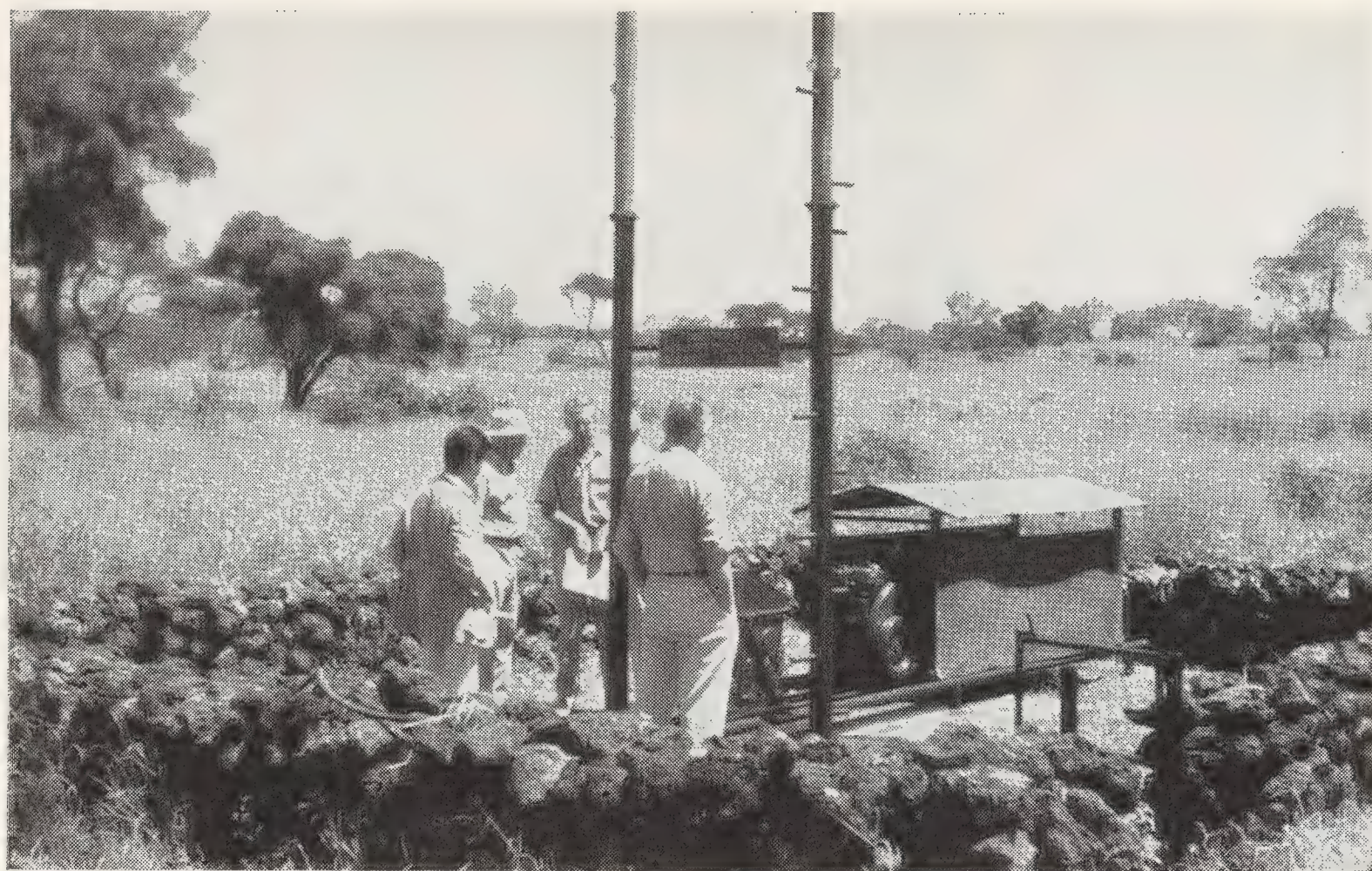
East, and then turned west, back over the Yatta Plateau and beyond the Athi River where we saw over 200 elands in one herd. On our flight back to Voi we crossed the Tsavo River which joins the Athi to form the Galana River. All these streams were well filled with water, but no animals were observed drinking. Water and grazing were so plentiful elsewhere that the game was well dispersed. While we did not have time to fly over the whole of Tsavo East, we did see from the air ostriches, baboons, impalas, gerenuks, zebras, elands, many rhinos, several hundred giraffes in small groups, buffaloes up to 70 in one herd, and possibly as many as 2,000 elephants widely scattered with not more than 50 at any one place. What had happened to the other 13,600 elephants? This is an interesting question, for which there is no exact answer because the wardens at Tsavo National Park have no airplane with which to follow the migrations of their animals and to combat poaching. The Government of Kenya provides the operating funds necessary for the minimum requirements of its parks — funds for extras like aircraft must come from outside. A small airplane, costing about \$12,000, would keep Tsavo's wardens in constant contact with their elephants.

After landing at Voi we were driven to Mudanda Rock where Mrs. Sheldrick provided a delicious buffet luncheon for the party and we continued to discuss the mystery of the disappear-

Elephants, rhinoceroses and buffaloes are not a novelty to visitors to the Tsavo Park, but it is certainly unusual for them to be as tame as these animals at Warden Sheldrick's home.

David Ming-li Lowe Photo





The sign between the poles marks this pumping station as having been donated by the New York Zoological Society in 1961. It supplies a nearby waterhole where animals come to drink.

Helen S. Buckley Photo

ing elephants. Even as we ate and talked, several small groups of elephant appeared out of the forest and bathed and drank at the large semi-circular pool extending from the base of this huge outcropping of rock to the edge of the trees beyond.

In our luncheon discussions it became apparent that the drought of 1961 was an unusually severe one and that perhaps elephants from far outside the park had been attracted by the only certain source of water available—the Athi, the Tsavo and the Galana Rivers, all within Tsavo East. With unusually heavy concentrations of game at the rivers and all natural scattered water catchments dried up, the vegetation near the rivers took an awful beating. The year 1962 on the other hand was an unusually wet one, and grazing and water conditions were so good everywhere that the wildlife did not concentrate as usual at the rivers, even in January (normally the dry season) when we were on safari. On both the Seronera at Serengeti and the Uaso Nyiro on the Northern Frontier we found very little game at the rivers. It was widely dispersed and apparently able to support itself on the green grasses and other water-laden feed available elsewhere. So perhaps Tsavo's surplus elephant population of 1961 has migrated back to its former feeding grounds outside the park.

In the meanwhile, what are Col. Cowie and his chief wardens doing about the elephant problem? First, they must determine, by aerial surveys and other means, whether the permanent resident population of elephants in Tsavo East is

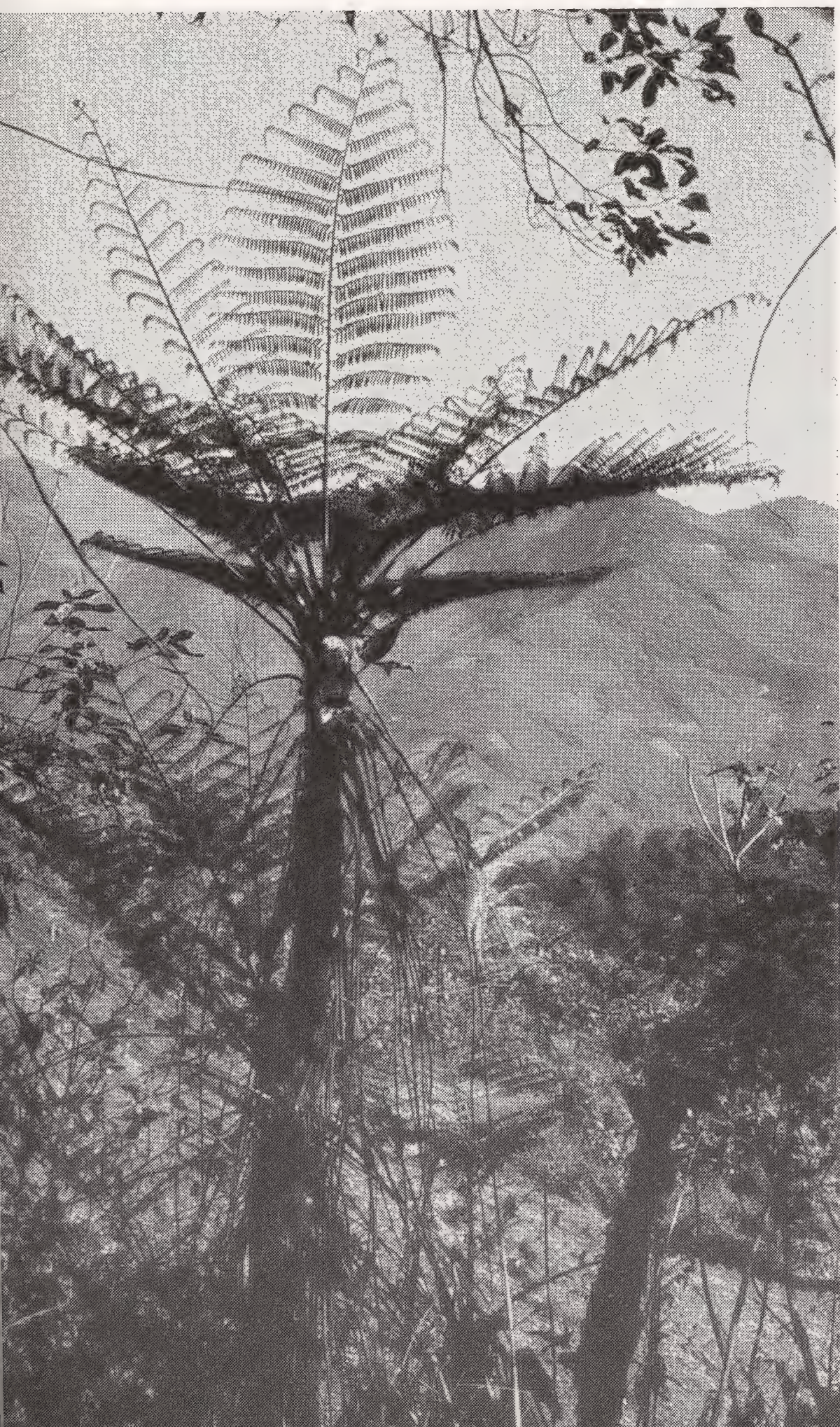
in excess of the carrying capacity of the habitat. If it is, an orderly small program of cropping will be carried out in conjunction with an existing game management plan next door, similar to that used in the United States national parks in controlling bison and elk populations. Next, they are making plans to prevent another crisis resulting from drought conditions such as those of 1961. By drilling boreholes at many of the natural water catchments and pumping during the dry season, elephants and other game can be kept better dispersed so as to avoid over-concentration and over-grazing near the rivers. Also by building adequate fire breaks on the northeast boundary of the park, they hope to prevent fires started outside from being blown into Tsavo by the prevailing northeasterly winds. In the past fires have destroyed many of the trees at Tsavo upon which the elephants partially depend for food. To buy airplanes, drill boreholes and build fire breaks requires money not immediately available from the Kenya Government. Investments for practical purposes such as these supplement in a tangible way related work of the Society in Africa devoted to wildlife education and field research.

How can we in America help? There is no more effective way than by making contributions to the New York Zoological Society, to be credited to its African Wild Life Fund. In doing this a contributor can be assured that every dollar sent in will not be subject to overhead or other charges and will be expended over there where help is so urgently needed.

Hunting for a Chromosome in the Jungles of Guatemala

By KLAUS D. KALLMAN

Geneticist, New York Zoological Society



MANY EXPEDITIONS studying live animals in far distant places have been supported by the New York Zoological Society. But this year an expedition of the New York Aquarium, besides collecting fish, was literally hunting for a chromosome in the almost trackless jungles of the Petén district in northern Guatemala.

A chromosome is not a live animal, of course, but a tiny strand of protoplasm so small that even if you could line up a quarter of a million of them, you would still have difficulty seeing them.

We had never seen the particular chromosome we were hunting, so how does one go about tracking it down and recognizing it? The task is not quite as formidable as it sounds. Chromosomes play a vital role in the inheritance of all plants and animals and they are found in the nuclei of living cells. Specifically, on this expedition I was looking for a peculiar sex chromosome of the platyfish, *Xiphophorus maculatus*, a small and

A tree fern in the foreground, the highlands of Guatemala rise beyond. It was through this kind of country that the Genetics Laboratory's expedition searched for a sex chromosome.

Klaus D. Kallman Photo

common aquarium fish familiar to many hobbyists. This fish is unique in that it possesses two types of sex-determining mechanisms, a peculiarity first discovered by the late Dr. Myron Gordon, founder of the New York Aquarium's Genetics Laboratory.

He found that the platyfish in the Río Jamapa, Río Papaloapan and Río Coatzacoalcas in Mexico possessed one type of sex-determining mechanism, XX females, XY males, while those in the Belize River in British Honduras possessed another, WY females, YY males. Nothing is known about the sex chromosomes carried by platyfish populations that live in the rivers in between.

Platyfish with different sex-determining mechanisms are indistinguishable from each other and hybridize readily, but in the laboratory their sex chromosomes can be identified by appropriate



crosses. We are interested in finding out how these two mechanisms have arisen, whether populations possessing different mechanisms live in separate rivers or if they exist side by side, and whether one is an ancestral type that is gradually being replaced by the other. Answers to some of these questions may provide clues as to where these two distinct platyfish populations originated and how the species is gradually changing.

Another aim of the expedition was to collect as many of the freshwater fishes of Guatemala as possible. The Río Usamacinta, with its headwaters in Guatemala and Mexico, is the largest river in Central America yet most of its branches have never been visited by ichthyologists. There are good reasons to believe that some of the fishes peculiar to Middle America, South America and the West Indies may have originated in the area. But only when this fish fauna is carefully studied will we be able to understand the origin, evolution and present-day distribution of fishes in this part of the world.

Dr. Donn E. Rosen of the American Museum of Natural History joined me on the expedition. We planned our platyfish chromosome hunt so it would take us to the headwaters of the Río de la Pasion and the Río San Pedro in the Petén district, and we also hoped to visit Lake Petén, the swamps near Tikal and the Río Hondo—all critical sites, for here the headwaters of rivers flowing into the Gulf of Mexico come close to

streams which run into the Caribbean. Perhaps, we thought, in these areas both sex-determining mechanisms would be found in the same platyfish populations.

Our fishing equipment was rather unorthodox and was a surprise to most people who saw us at work. It consisted of plastic bags, temperature-insulated polystyrene containers, seines five to a hundred feet long and many gallons of fish toxicants to be used to drug the fishes and of formaldehyde to preserve them.

Although we discovered many species new to science or new to Guatemala at several sites, the most interesting and surprising episode of the expedition occurred on the trip to Sebol near the source of the Río de la Pasion.

Our starting point for Sebol and platyfish country was the Indian village of Coban at an altitude of 4,000 feet, near the northern end of the Guatemalan plateau. Here the road almost immediately deteriorated to a rough trail, hardly wide enough for a jeep. Although it followed a contour line along the south side of the range, progress was a slow ten miles an hour. The trail traversed coffee and banana plantations and large areas of scrub where the forest had been cut over and corn and beans grown for a few seasons. By now it had all reverted to wasteland, and on only a few hill-sides were there remnants of the native pine forest.

After three hours' travel the trail crossed over

the crest to the northern side and we began a gradual descent to the lowlands. We were now on the windward slopes of the northernmost mountain range of Guatemala, the side that faces the lowlands and catches all the moisture-laden clouds. Vegetation became more luxuriant and the land less ravaged as we descended from the pine forest through a region of tree ferns. Soon the rain forest closed in. The trail was lined with giant begonias four feet high, with great clusters of red, pink and white flowers.

From the steep mountain side we looked over the treetops to the great plain of northern Guate-

Sometimes it is practicable to poison a stream with rotenone and collect fish, but seining is necessary if they are wanted alive. Here Indian boys hold a seine in Laguna Encantada.

Klaus D. Kallman Photo

mala. Ahead of us there was the glitter of a small stream and — our hopes soared — the trail seemed to cross it.

An hour later we jumped from the jeep and looked down into the stream which proved to be a tributary of the Río Chajmaic a mile away. In the instant of looking we knew we had discovered a new swordtail. The water was crystal clear and teeming with cichlids, characins and swordtails — and the latter all possessed yellowish dorsal and caudal fins and, most remarkable, a big patch of black pigment near the base of the tail. Such a pigment pattern had never before been seen in any swordtail, although literally tens of thousands of swordtails had been collected throughout the range of the species.

The swordtail, *Xiphophorus hellerii guentheri*, which occurs abundantly from southern Vera Cruz in Mexico to Honduras, is characterized by a series of red stripes along the body and by rows of red spots on the dorsal fin. Thirty years earlier, ichthyologists had searched Sebol by boat from the opposite direction and had collected only the red variety. The ones we were now seeing for the first time were distinctly and definitely different.

We went to work. The seine was suspended from the small wooden bridge across the stream, the sink line weighted with rocks to carry it to the bottom, and the ends were secured with ropes to trees along the shore. The seine formed an effective barrier across the stream. Next we poured

a small amount of rotenone, the fish toxicant, into the stream some 150 feet above the bridge. This poison constricts the gill capillaries through which fish absorb oxygen from the water. Fish first affected are the ones with high oxygen requirements, such as cichlids and characins. They cease swimming against the current, drift downstream and accumulate in the net. Some try to beach themselves along the shore. All we have to do is pick them up and preserve them in 10% formaldehyde, ready for shipment to New York and careful study in the Genetics Laboratory.

The rotenone method is advantageous in that all fishes occurring in a particular part of the stream are driven into the seine, regardless of whether they live in the center, under boulders, in holes or in dense vegetation. The toxicant is rapidly deactivated and fish further downstream are not affected. Furthermore, fish caught by this method are fit for human consumption. Of course, rotenone cannot be used if you want to catch fish alive and keep them for breeding; these must be captured by smaller hand seines.

Our burst of activity attracted a dozen Indians who suddenly appeared from behind the trees. They were fascinated by our easy way of catching fish, for Dr. Rosen and I merely stood on the bridge and watched while thousands of fish drifted into the net. When we told the Indians that they could have the big cichlids and characins, they stripped and dived headlong into the stream to help us retrieve the ones we wanted. Their women shyly watched from the hillside.

While our harvest was in full swing an ancient, dilapidated bus appeared — the only link between Sebol and the outside world. It promptly stopped and within minutes the passengers were in the river too, helping us gather fish.

Discovery of the new swordtail was so unexpected and so especially exciting because swordtails have been collected and studied by the Genetics Laboratory for more than twenty-five years. However, from a scientific point of view, of much greater importance was the discovery of a small, rather nondescript fish only an inch long which we found in our seine. It represents a new genus resembling the *cnesteredontins* in South America. This seems to indicate that the *cnesteredontins*, like many other *poeciliids*, may have had their origin in Central America.

A third unexpected fish in the seine haul was a species of characin so far recorded only from Lake Nicaragua.

But despite these important discoveries, we did not find a single platyfish! And they, of course, were what we were searching for.

Late in the afternoon we followed the trail northward and crossed the last ridge to arrive in Sebol, the outpost of civilization. To the north, east and west there was only untouched rain-forest. Beyond Sebol we continued by dugouts and in due course we caught hundreds of platyfish and plenty of swordtails — but of the latter only the red-striped variety. There was no trace of the new swordtail or any of the other interesting new species we had caught the day before.

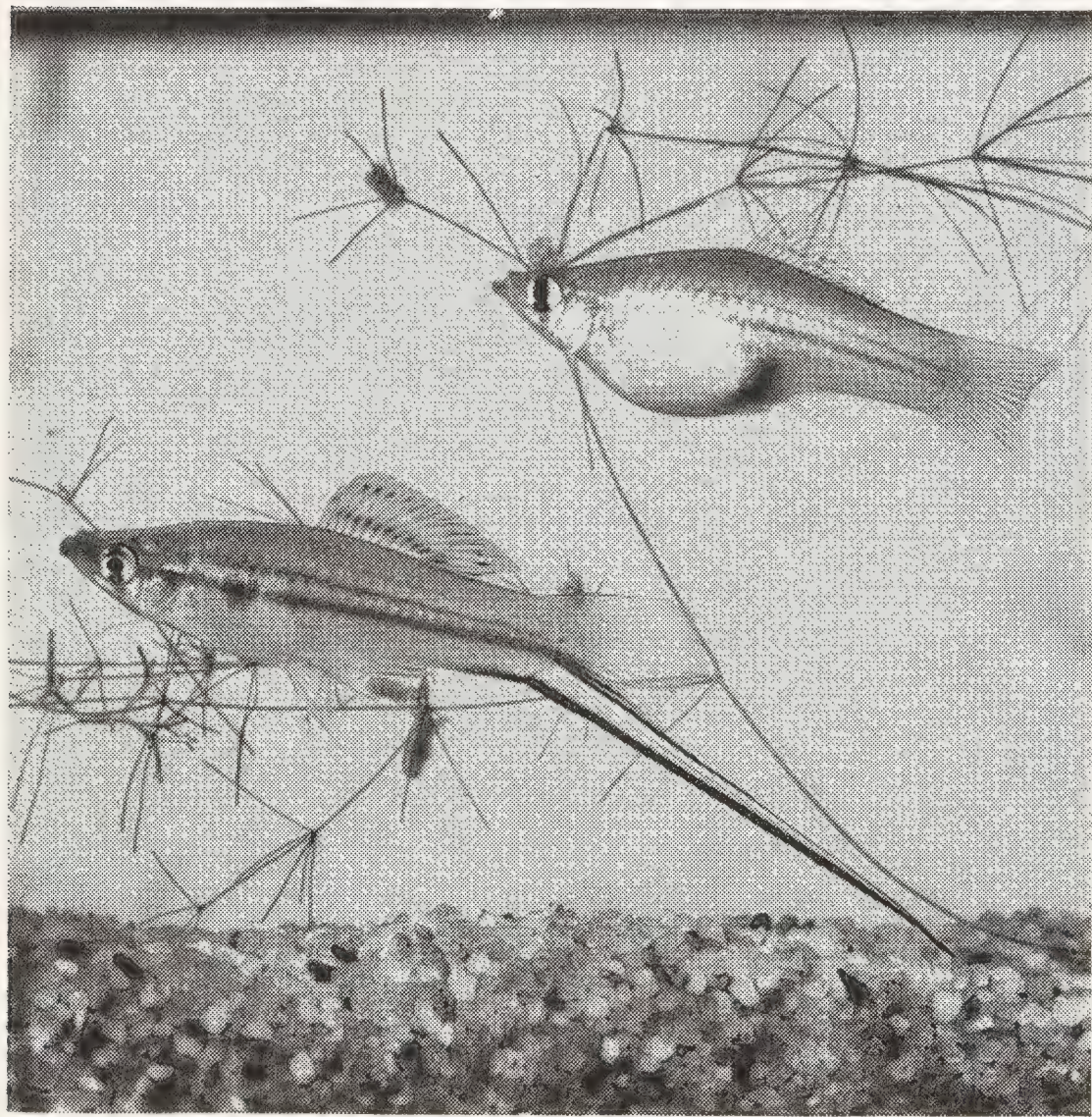
Including the platyfish and the common sword-

tail, we caught at least eight species of poeciliids in the streams around Sebol. All are common fish which occur in many places in Mexico, Guatemala and Honduras. But on the day before we had found only one of them, the “false swordtail,” *Heterandria bimaculata*, associated with the new swordtail. These striking differences between the fish fauna of the two localities puzzled us.

On the return trip we could not resist trying to capture the new swordtails alive, to bring back to New York and add to our collection of swordtail stocks. But whereas two days previously we had captured several thousand fish within an hour and a half by the rotenone method, it took more than two hours and the combined effort and wits of three men to capture just sixteen of these fast and agile fish alive. They were either hiding in the vegetation, where they were safe from our seine, or would escape just before we closed it.

Our official objective to Sebol had been platyfish and I dared not jeopardize these by crowding them with the new swordtails — which were strictly “extracurricular” fish. All I could do was place them in a plastic bag in a pail. I was not worried about temperature, for the trail led straight up the mountains where it would be cool. Actually, all were alive when we arrived at Coban.

The next day we continued to Guatemala City, and for the first four hours were in the highlands and it was pleasantly cool. But then the road not only deteriorated but dropped to an arid desert valley only a few hundred feet above sea level. The temperature climbed steadily and was soon over 100°. There was not a shady tree any-



Above — The red-striped swordtail is commonly found from southern Vera Cruz in Mexico to Honduras. Right — But how different is the new swordtail, surprisingly discovered only in the Rio Chajmaic!



where, and although I had replaced the air in the plastic bag with oxygen, I doubted that the sword-tails could survive such extreme temperatures. Still, there was nothing to do but to continue crawling along the winding and dusty road. Late in the afternoon we reached the paved Puerto Barrios-Guatemala City highway, and within an hour were up to 5,000 feet and more moderate temperatures. Seven swordtails had died.

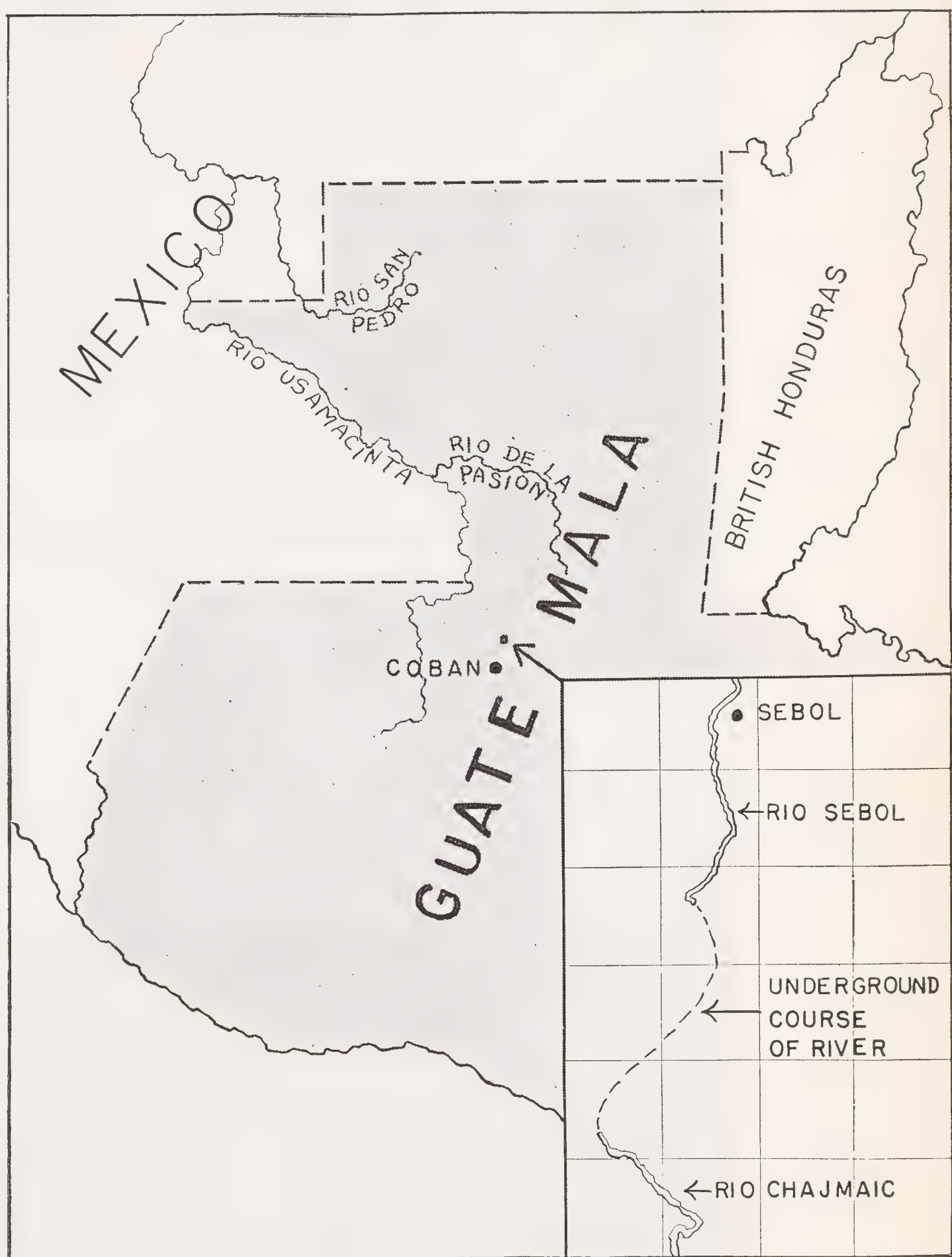
The next day only six were still alive and they had to face one more, and a most unexpected, hazard. The flight to New York via New Orleans was to leave at 4:30 p.m. In plenty of time I placed the fish in their shipping cartons, supplied with liberal amounts of oxygen, and at 3 o'clock they were weighed in at the airlines counter. Confidently I displayed their health certificate, stating that they were free from communicable and infectious diseases.

That was fine, but where was the export license?

The export license? Yes; we had to have one. Obviously we had not been adequately briefed on Guatemalan regulations, for only now did we learn that an export license should have been applied for, on official stationery, many days in advance.

With hardly more than an hour to go, we raced with our interpreter to the Customs office and told the story of the little fishes to officers who were, perhaps, a little incredulous at first, but whose interest was finally aroused. And then a miracle happened. There were many telephone conversations between Customs and the airport, and just in time a special permit was issued. A few minutes later the fish were on their way and in less than 24 hours all six were swimming in the tanks at the Genetics Laboratory. Since then they have bred and now we have hundreds.

But in the back of our minds during those last days in the field was the question as to why the new swordtail and the other new species were found only four miles south of Sebøl in the Río Chajmaic and nowhere else, and why so many common fish are *not* found there. The answer was finally given by the "Dirección General de Cartografía" in Guatemala City. The Río Chajmaic flows north until it reaches a low ridge just south of Sebøl. It flows half way through the ridge in a canyon, and then suddenly dis-



Not all of Dr. Kallman's journey through Guatemala is pictured on this map. Principally it shows the area where the Rio Chajmaic suddenly disappears, emerging as the Rio Sebøl.

appears underground. Exactly 1.6 miles away it reappears under a new name, the Río Sebøl. Obviously the underground passage is an effective barrier to the dispersal of many fish. The isolated river may function as a sanctuary for the newly discovered poeciliid and characin, which at one time may have been much more widespread before they were replaced in most other areas by other species. The swordtail may have evolved independently, in isolation from the common swordtail a few miles away.

And the sex chromosome we set out to track down? Well, we are now making the appropriate crosses in the Genetics Laboratory, and by the end of the year we should know whether we found what we were looking for.

There have been plenty of Zoological Society Garden Parties that were different, but few that were more enjoyable than the "Big If" party at the Zoological Park on June 6. The "big if" was the doubt in the staff's mind whether the animals would do what they were supposed to do. Mainly they did. On the pages that follow are scenes of our Members, our animals and our staff taking part in events on Baird Court.

*and a good time
was had by all!*

Photographs by RUSS KINNE



Eliza Reed, 7, was an easy winner in the tortoise race, guiding her steed with a banana. Young Gregor Hodgson was left far behind. Here Gordon Cuyler presents the victor's trophy.



One of the surprises of the afternoon — to the staff — was the cooperativeness of the large Reticulated Python. We promised to stretch it out and measure it, but expected a hard time straightening it out. It behaved well and was measured at 18 feet 11 inches, plus a few kinks.





In grotesque mask and gown "Mother Goose" (Keeper Eric Edler) demonstrated imprinting of goslings. They saw him soon after hatching, so he is "mother" to them and they follow him.



Slightly older goslings ran a race with members of the Bird Department staff. At this point, just at the start, the keepers were in the lead, but the goslings forged ahead and won handily.



"Chippy," a Panamanian River Otter, was one of the more pettable animals in the show. Phyllis Linnemann of our Education Department regularly takes Chippy on visits to schools.



Another great favorite was "Cocky II," a Sulfur-crested Cockatoo who was carried around the ring by Keeper Pat Clarke, to the joy of children when Cocky "sneezed" and raised his crest.



After parading, the Farm's mare, "Midnight Glory," and her foal, "Glory Lad," approach the awards table for a snack of hay.

Not unexpectedly, a Prehensile-tailed Porcupine was the winner in a pole-climbing contest, in competition with a tame Potto.

"Ginger," the dromedary, seemed to enjoy being led by Joe Scheller of the Riding Track without a load of children on her back.



"OPERATION ORYX"

EDITOR'S PREFACE

ALMOST OVERLOOKED in the city's preoccupation with a reception for Astronaut Cooper, four Arabian Oryx arrived in New York near the end of May. They deserved more attention, for they were a significant "first" — the first critically endangered mammal deliberately captured, combined with a zoo specimen, and shipped to another country, not for exhibition but as a nucleus breeding herd. England, the Aden Protectorate, Kenya and the United States were involved in varying degrees in the formation of this international pool, and their cooperation is a most helpful and promising example of what can be done when a species is threatened with extinction.

Admittedly, it is a better conservation practice to leave animals in the wild, under strict protection, but when protection cannot be guaranteed (as the article that follows makes clear), sanctuary in a zoological park may be the only hope.

The four Arabian Oryx, three captured in the Aden Protectorate and one female contributed by the Zoological Society of London to round out two pairs, are now in the Phoenix Maytag Zoo in Phoenix, Arizona, where favorable climate and devoted care will give them every chance to reproduce their kind.

The capture story below is an abridgement of "Operation Oryx," an article in the December issue of *Oryx*, the journal of the Fauna Preservation Society of London, of which Dr. Fairfield Osborn is a vice-president.



*Drawing of
Arabian Oryx head
by Nancy of Pinon.*

By MAJOR I. R. GRIMWOOD

Chief Game Warden, Kenya
Leader of the Expedition, "Operation Oryx"

THE ARABIAN ORYX [*Oryx leucoryx*] once inhabited suitable country throughout the Arabian peninsula and northwards into Sinai, Palestine, Jordan and Iraq, but has been so reduced that in recent years reports of its existence have come only from a narrow belt of country running along the southern, and possibly eastern fringe of the Rub-al-Khali deserts. Of this belt accurate information was obtainable only about the western half, i.e., that part lying within the Aden Protectorate.

The habit of the oryx, either natural or as the result of persecution, is to live during the cold weather largely, but not entirely, within the sand

sea. During summer, however, they require shade in which to lie up during the heat of the day and as shade is unobtainable amongst the dunes, they move out on to the gravel plains of "jol" to the south. Here there are a few scattered bushes and caves in which to shelter. Though the oryx live in small parties of from one to seven individuals, it appears that there are certain chosen areas of jol in which they tend, or tended, to congregate, forming loose populations, which may be concentrated by the presence of fresh vegetation in any part in which rain has fallen.

In 1959 the last population known to survive in the Protectorate was estimated to number between eighty and one hundred. The reason for its survival was the remoteness of the area, which was used only by a few Beduin, who can have killed no more than four or five animals a year.

In December, 1960, however, a party of armed raiders from outside the Aden Protectorate prepared a motorized expedition and having apparently crossed the whole of the Rub-al-Khali from the north, arrived at the Ramlat Mitán, in which vicinity they remained and hunted for several weeks. This party, hunting from cars, is known to have killed at least forty-eight oryx.

The Arabian Oryx is, by its vigilance and ability to travel great distances, more than a match for the Beduin hunting on foot or camel back. But the oryx is helpless against motorized hunters, for on the jol [gravel plains], 99 per cent of the country carries a good spoor and 95 per cent of it can be traversed by car. It is therefore simply a matter of following up an animal till it is sighted — spooring at speeds of 20 miles per hour being possible — and then running it to a standstill.

In August, 1961, as the result of a series of meetings at the Fauna Preservation Society's headquarters, it was decided that the Society should launch an operation in the Eastern Aden Protectorate to capture a sufficient number of the surviving oryx to form a breeding herd. Thus the oryx could be saved from extermination and when circumstances became favorable reintroduced into some part of its original habitat.

The operation was timed for April-May, 1962, when heat would have driven the oryx south out of the sand sea, but before temperatures had risen intolerably.

In February, 1962, came the news that the raiders had returned to the Wadi Mitán in the previous December and had killed another sixteen oryx. Next, a report was received according to which all oryx had been destroyed. Could the expedition continue? An anxious meeting was held in London and a telegram asking for advice was sent to the Governor of Aden, Sir Charles Johnston. Back came the reply: "Oryx report mentioned is corrupt and no such categorical statement was made but no certainty is possible. I advise expedition should continue as planned."

[Leadership of the expedition had been entrusted to Major Grimwood and preparations went ahead on many fronts, in Aden, Britain and Kenya. A special catching car was built in Kenya, a light airplane was made available by the East African Wild Life Society, collapsible crates were built, radio equipment and a radio beacon obtained, supplies of many kinds laid in. At the end of April the bulk of the expedition reached its forward base at Sanau.]

It was known that if any oryx still existed they would be found in an area stretching from 50 miles east of Sanau up to the Dhofar border. The capture method proposed was that which had proved successful with beisa oryx in Kenya, that is to say noosing from a moving vehicle. For this a fast cross-country vehicle with high acceleration is necessary, so that an animal can be shepherded from a distance on to the piece of ground selected and then, at the right moment, quickly closed. The noose is wielded by a man who stands supported by a pulpit-like rail which is built as far forward as possible. The noose and the rope leading to it are tied by light threads, or otherwise secured to a long pole with the other end made fast to the vehicle.

At the right moment the noose is slipped over the animal's head, the pole broken away and the noose drawn tight. The animal is then secured — not always an easy matter in the case of one as aggressive and well-armed as an oryx — blindfolded, given a tranquilizer or such other drugs as are thought necessary, put in a crate, and the blindfold removed.

The field party had hoped to hear news of oryx on arrival at Sanau, but though the garrisons of both that fort and Habarut had been alerted for the last few months, no sign of these



animals had been reported since the murderous raid in December. It was also learned that the party had been at work again in January, having either stayed the whole time or having returned for a second hunt.

[On the advice of one of the expedition's guides, the party moved to a camp east of Sanau and began a series of sweeping searches by car and airplane. In the next few days tracks of several animals were found and by May 5 hope was running high.]

Next morning the hunting party was under way by 0420 hours, working through an area where grass was more plentiful and fresher. At 5 o'clock fresh tracks of a single oryx, made during the night, were encountered and were shortly joined by those of another animal. The hunt followed the same pattern as before with Mabkhout and Tomatum [the guides and trackers] following up the spoor, sometimes on foot and sometimes in the Landrover, while the catching car cast ahead in the hope of getting a view — the

Sanau, in the eastern part of the Aden Protectorate, was the base of the "Operation Oryx" expedition, and captures were made from camps established in the desert beyond Sanau.

Reprinted by permission of "Oryx"

lorry with the crates following some distance behind. As in the previous hunt the oryx had kept steadily on the move, making their way from one grass-lined depression to another, this time heading north.

At 8 o'clock Stewart [D. R. M. Stewart, game biologist of the Kenya government] and Grimwood in the catching car saw a single oryx through their binoculars, galloping up the slope of a low hill to the left, over which it disappeared. The car immediately gave chase but when the other side of the hill was reached the ground was found to consist of a series of reentrants and valleys amongst which no sign of the oryx, or even its spoor, could be found. The trackers were getting impatient. They had been



Major I. R. Grimwood, leader of the expedition that resulted in the capture of three of the four Arabian Oryx that have now come to the U.S.A. He is Chief Game Warden of Kenya.

Photo by J. Hillaby

following up the other animal and had just found fresh droppings, so search for the first oryx was abandoned and the hunt continued on the tracks of the second. It headed north-east, sometimes running and sometimes walking, which suggested that it was uneasy, but did not yet realize that it was being hunted. After a while the oryx slowed to a steady walk and, as the going was across a soft sandy plain, the trackers were able to follow in the Landrover at a steady 15 m.p.h. The catching car lay well forward and to the left, to intercept a probable line of flight to the dunes, now once more in sight.

At 0950 hours a small wadi was reached in which grew a few scrubby bushes. As the catching car entered it an oryx rose from under a bush 200 to 300 yards away and stood for a minute

looking dazzling white in the sun. Then luckily it left what, had it known, would have been the relative safety of the sandy bed of the wadi and set off across the plain with the catching car in pursuit. It displayed none of the wiles of the beisa oryx, running straight and rather slowly and showing no inclination to stand and fight.

As the car closed with it the oryx made one rather half-hearted attempt to attack, crossing the car's bows as it did so and, because the pick-up was too clumsy to manoeuvre, receiving a bump which rolled it over. It was on its feet at once, however, apparently unhurt. A few hundred yards more and the first attempt to noose was made, but the noose, though it went over the horns of the oryx, missed its muzzle and was thrown off. The second attempt was successful, catching both its head and one foreleg. Once noosed the animal was quickly secured. It showed no fight, as was expected, and was in any case less than half the weight and size of the 400 lb. beisa oryx on which the team had practised. After being blindfolded and having its legs tied with soft bindings, the oryx was given an anti-shock injection and allowed plenty of time to recover its wind before being lifted into the crate. Then its legs were untied and the blind-fold removed.

This first hunt had gone according to plan, only eight minutes having elapsed between the animal being sighted and its capture, which meant that it could have suffered no damage from exhaustion. The hunters were inclined to be pleased with themselves.

The animal, which was a mature bull, showed a behaviour pattern, repeated in the other animals caught, quite unlike that of any other wild animal, in the experience of any member of the field party. From the moment of capture it displayed complete resignation to its fate, showing no sign of alarm and only occasionally uttering the characteristic oryx warning snort of anger, even when the inspection trap of its crate was opened and it saw a human face to face, at a range of a few feet. It made no attempt to attack and even permitted without protest mild handling in its crate and the removal of ticks, with which it was heavily infested, particularly on the withers and between the hind legs.

[On May 8 three oryx were sighted and a male

and a young female were captured. The male died after it was crated—the only loss of the whole expedition. A bullet was found in one haunch and it is probable that weakness from its wound contributed to its death.]

The situation now was that roughly all oryx country had been reconnoitered. In recent years oryx had been known to come out of the sand sea only on the 100-mile front between the wadi lying 60 miles to the east of camp and the wadi 40 miles west of camp and they had not been seen more than 70 to 80 miles south of the sands. The camp wadi could be regarded as dividing this 8,000 square mile rectangle into two blocks. In both of them the oryx area was limited by the presence of grass, which in 1962 seemed to be confined to a belt lying between 15 and 40 miles from the sands. Two oryx had been found in the western block and three in the eastern. In addition it was known that four, perhaps five, others had been in the eastern block shortly before the hunt began. The oryx which had been seen but not caught in the western block and the survivor of the three in the eastern block had been thor-

oughly scared and had probably headed back into the sands. It was therefore decided to concentrate on the five which had not yet been disturbed.

On 19th May the hunting party set off for the last hunt in the eastern block, heading north-east so as to cut the line of the dunes three-quarters of the way to the eastern wadi. A dawn flight had shown a few green patches to exist along the foot of the southernmost dunes from near the mouth of the camp wadi to this point and it was thought that any oryx emerging from the sands was most likely to do so in this area.

[The track of a single oryx was found that day and on the following day it was traced to the edge of the “green belt.”]

With the easier going, Tomatum and Mabkhout who up to now had been working on foot, running on the spoor, casting ahead and sup-

Shelter houses and corrals for the Arabian Oryx at the Phoenix Maytag Zoo. They will be given plenty of seclusion, for the outside fence all around the enclosures keeps the public at least 15 feet away.

Photo by Mishler—Arizona Zoological Society



porting one another like a couple of good hounds, were able to show what they could do in the way of high-speed tracking. The oryx, though feeding, had not been wasting time and had made its way steadily southwards across a series of open plains. The Landrover, carrying both trackers, kept up an average of a good 15 m.p.h., and sometimes reached the amazing speed of 25 m.p.h. without losing the trail. The oryx was being rapidly overhauled.

Soon the best of the grass country was left behind but the oryx still kept purposefully on its way across an area of stony jol. At last it entered a narrow valley with a sharp ridge of low cliffs on the left and a few bushes growing in the wadi bed in the centre. It seemed certain that it would be crouched either under one of the bushes or in a cave in the cliffs.

The Landrover, following the spoor, veered left and began to make its way up the lower slopes of the ridge, when suddenly the oryx leapt to its feet some 20 yards ahead and with a series of rather clumsy bounds reached the sky-line. There it stood poised for a second or two before disappearing down the other side of the ridge. The catching car swung in a half-circle and charged the ridge, luckily finding a practicable route to the top. The other side was steep but not impossible and on reaching the bottom the oryx was

seen loping away across a level plain, no more than 600 yards ahead. Before it had gone another 600 yards the catching car was alongside and, since the oryx neither attempted to attack or turn away, it was noosed at the first attempt.

This animal, which to everyone's disappointment turned out to be another bull, was almost certainly the third animal of the trio seen on the 8th, being recognizable both from the shape of its horns and from its spoor. In following up its wanderings over the last 24 hours the cars had done 58 miles and the animal probably several miles more, giving an indication of the distances which Arabian oryx can travel. Also, in remaining couched until the car was almost on top of it, the oryx had repeated the action of the first bull caught, suggesting that the species does not always resort to flight, but regards hiding as an alternative means of escape.

Next day, 21st May, a party set out for a last hunt in the western block. No more recent spoor was seen. A final search was made where the wadi discharged into the sand sea and then, after a cast to the east to complete the traverse of the dune line, the party returned home and the hunt was over.

EDITOR'S POSTSCRIPT

A FEW DAYS later the Royal Air Force flew the three oryx from Aden to Nairobi. Holding pens had been prepared at Isiolo, but foot-and-mouth disease broke out in that area and the animals were compelled to spend six weeks in Nairobi until Isiolo was cleared.

For various reasons, including unsettled conditions in Kenya, it was decided to move the little herd out of Africa — a wise decision, for five days after they left in May of this year, Somali secession riots broke out at Isiolo and there was a battle in the area of the holding pens.

Major Grimwood made a survey of possible sanctuaries and chose the new Phoenix Maytag Zoo in Arizona where the climate approximates that of the native home of the oryx. The London Zoological Society, which had an elderly male

"Tomatum," one of the wild-caught males, in his stall at the Phoenix Maytag Zoo on June 25. He has already shown signs of interest in "Caroline," from London Zoological Society.

Photo by Mishler—Arizona Zoological Society



And this is "Edith," another one of the three animals captured in the desert, on July 1, her first day outside at the Phoenix Zoo. The board is to keep her from catching her horns in the wire of the fence.

*Photo by Mishler
Arizona Zoological Society*



Arabian Oryx and a fine four-year-old female, contributed the latter to the "world pool," and this animal, named "Caroline," joined the three wild-caught oryx as they passed through London on their way to America.* The three, incidentally, had been named "Edith," "Pat" and "Tomatum," the latter after one of the trackers.

Two shelter buildings, each with stalls for two animals and with individual fenced runs 30 feet wide and about 180 feet long, were built at the Phoenix Zoo in preparation for the arrival.

Support for the protracted holding operation in Kenya and for transportation by air to the United States was given by the Shikar-Safari Club of Los Angeles and its president, Maurice Machris, advised on many of the details of the transfer.

All went smoothly. On May 23 the four animals arrived at Idlewild Airport and were met by Robert Mattlin, Director of the Phoenix Maytag Zoo, who rode with them to the Federal Quarantine Station at Clifton, N. J., where they were to be kept in isolation for thirty days. Dr. H. A. Waters, Veterinarian in charge of the station, reported at the end of their quarantine that they showed no evidence of disease and had been on a

diet of grass hay, rolled oats and bran. At the end they were given tranquilizers before being crated for air shipment to Phoenix.

The unexcitable nature of the animals was proved again when they were uncrated at Phoenix. Despite the heat — 104° to 114° by day, dropping to 70° to 84° at night, with 25% humidity — they have been taking only about a quarter to half a bucket of water a day. Caroline, accustomed to the London climate, has shown more reaction to the heat than the other animals.

The latest word from the Phoenix Maytag Zoo is that Tomatum and Caroline have been rubbing noses through the fence!

* * *

As a final note to this account, our own experiences with the Arabian Oryx may be recalled. At the beginning of this century no one dreamed that a major international effort would one day have to be made to save the animal from extinction. In 1903 we bought a male from the Hagenbeck firm in Hamburg for \$725, and on 1906 got a female for \$175 from Bostock's Arena at Coney Island. In the next eight years they produced four young, the last of which died in 1925. From the evidence of our own publications, no one seems to have thought of them as particularly rare — and, indeed they were not rare in those days. But the forces of annihilation move swiftly. Sixty years hence, what other animals now considered plentiful will be the subject of an "Operation - - -"?

* Late news has been received that the ruler of Kuwait has presented a female Arabian Oryx to the Fauna Preservation Society for inclusion in the Phoenix herd. The animal, about four years old, should arrive during the summer. It is also reported that wild Arabian Oryx are known to be in the Harasis area of Muscat and that the Sultan's strict orders for their protection are being observed.

The Art and Practice of Zoo Keeping

By JOSEPH BELL

Acting Assistant Curator of Birds

THE ONLY REAL WAY to learn the Zoo Keeper's trade is, quite obviously, to work in a zoo. Here in the Bronx Zoo we use a kind of apprenticeship system for training our keeping staff. The earlier part of a keeper's career is spent working under experienced men in various divisions of a department. The new man gains a lot of general background knowledge and we learn where he will be most valuable to our operation.

Early in the spring of 1944, when I had completed a year of work in the Large Bird House, I was assigned to the Aquatic Bird House as Assistant Keeper. This division of the Bird Department also included what was then, and still is, one of the finest collections of predatory birds to be found anywhere. The care and feeding of the Birds of Prey was to be my special responsibility.

The first nice morning Ed Grebe, then Keeper in Charge at the Aquatic Bird House, deposited me, loaded down with hip-boots, water hose, iron rake, broom and scrub brush, in the first cage of the Eagle Aviary. He gave me the following short lecture:

"Don't go in with the Crowned Eagle." (Still in the collection and his temper hasn't improved).

"Don't take any nonsense from 'Satan'—she is just bluffing." (A Hooded Vulture. This creature would put on a great show with a display dance when you entered her cage).

"Don't trust the White-tailed Sea Eagle. He *isn't* bluffing." (This old rascal will still charge you from the rear if you don't watch him like a hawk).

"Don't bother 'Old Nellie.' She's too old to be annoyed with junior keepers." (This Griffon Vulture was in the collection for over forty years).



Author and friend — an immature Bateleur Eagle

"DON'T LET ANYTHING OUT."

"GET THIS PLACE CLEANED UP."

I looked around to reply but Grebe was gone.

My nerves were in for their first strain as soon as I turned back to the cage. A huge bird, with a pale unfriendly eye, was studying me from a perch just over my head. I guess all new keepers experience this size illusion the first time they are on the "inside," for at a second glance this "huge" bird turned out to be the same small male Bald Eagle that I knew so well from outside the cage. All of the birds seemed to have one neat little trick in common to play on me that day. They would let me enter the cage and do my work but take up a position on the perch just over the exit door and dare me to pass below them when I had finished.

I spent several interesting (but anxious) hours working my way through the long row of cages without serious incident, but then as a grand finale I managed to lock myself in with a large South American Condor. We had a chance to study each other at close range for about half an hour (it seemed much longer), after which Grebe came to let me out, saying I should not feel too badly as every new man locked himself in that particular cage.

The time that I spent working with these birds was an interesting and happy part of my apprenticeship and I came to know, like or at least respect all of these birds. The first day I spent there, however, is the one I will always remember the most.

After all, just one year earlier I had been chased out of a cage in the Large Bird House by a ferocious Toucan.

News from the Conservation Foundation

The Pinchot Institute for Conservation Studies

A cooperative agreement has been signed by the U. S. Forest Service and the Conservation Foundation to administer a new Institute for Conservation Studies. It will be housed at "Grey Towers," the Milford, Penna., estate of the late Gifford Pinchot, first Chief Forester of the United States. The property was sold to the Foundation for this purpose by the Pinchot family and title was transferred to the Forest Service, which will improve and maintain it hereafter.

Co-directors of the Pinchot Institute for Conservation Studies will be Dr. Matthew J. Brennan, Chief of Conservation Education for the Forest Service, and Dr. Paul F. Brandwein, Director of Education for the Conservation Foundation.

The program will provide facilities for conservation group meetings and studies, workshops for teachers, conferences and seminars. It will also be used as a center for the development, testing and publication of conservation education materials for all levels of the school curriculum.

The Institute will be dedicated this fall, at which time further details on its use will be announced.

North American Wildlife

A substantial grant has been received to assemble an international group of natural scientists, ecologists, economists and land-use planners to explore the impact of predicted land-use changes on the future of wildlife in North America. It is hoped that the group will recommend procedures to assure a reasonable variety and abundance of natural habitats and animal populations in the face of anticipated industrial and urban expansion and increasing human pressures. Some members of the staff of the New York Zoological Society will participate in the planning of the project. It will study projections of geograph-

ical and ecological conditions on the continent over the next 50 to 100 years.

Open Space Action Committee

Another grant recently received has enabled the Conservation Foundation to organize an "Open Space Action Committee" which will employ a field representative to identify public agencies, such as school districts and park commissions, which desire to acquire and manage natural areas of land for school forests, nature study or parks — and then to identify private land owners who would like to see some of their woodland or marshland preserved for natural use. The Committee will bring the interested persons together to establish, preserve and manage such areas in the public interest. It is hoped that this will lift the open space program for private donors from the planning stage and develop a model formula for open space action.

Briefly Noted

Dr. William Vogt has just returned from his second reconnaissance in Central America, laying the groundwork for future land-use programs with conservation leaders in Mexico, Guatemala, San Salvador and Costa Rica . . . Dr. Frank Darling and Noel Eichhorn have concluded their second summer of observations for our National Parks survey. Parks visited this year included Olympic, Grand Tetons, Yellowstone, Yosemite, Mt. McKinley and Glacier . . . Friends of George E. Brewer, Jr., in both the Zoological Society and the Conservation Foundation, will be pleased to learn that he has recovered from his recent major operation and is now back at his desk . . . The "House of Man" has been developed into two ecological films. One embodies the educational aspects of the subject and will be the first film in a projected "House of Man Series." The second will be a documentary in association with Willard Van Dyke, to be shown primarily as an art film.

POPULATION EXPLOSION IN THE ZOO

Photographs by SAM DUNTON
Staff Photographer

Babies have been born in the Bronx Zoo every year since its opening in 1899, but the novelty and pleasure — to the staff as well as to the public — never wear off. This has already been an especially productive year; in addition to the youngsters pictured here, we have had Roosevelt Elk, Thomson's Gazelles, Blackbuck, Muntjaks, American Marten, a Mandrill, Nyalas and Small Malayan Mouse Deer — to say nothing of some 1,300 eggs from our bird collection, of which a few hundred are being incubated. And other babies are due soon.



American Bison calves



Formosan Deer fawn



Chinese Water Deer



Pigmy Hippopotamus



Agile Wallaby



New member of the Yak herd

Not born in the Zoo, but young newcomers. These African Forest Buffaloes were received from Ronald Lindemann, the Society's Consultant in Mammal Management



BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

Paul Montreuil Joins Staff of Aquarium as Curator

Paul Montreuil, Curator of the Quebec Aquarium, became Curator of the New York Aquarium on August 1. A graduate of McGill University in 1948 with a B. Sc. degree, he did post-graduate work at the Institute of Parasitology, Macdonald College of McGill University, toward the degree of Ph.D., to be completed with submission of his thesis.

For the past 14 years Mr. Montreuil has been employed by the Department of Fisheries of the Province of Quebec, as an assistant biologist doing research on culture methods for invertebrates as food for artificially-reared trout, as biologist in charge of field work at the Magdalen Islands, as Director of the Marine Biological Laboratory at Grindstone, Magdalen Islands, and, since 1960, as Curator of the Aquarium in Quebec.

Mr. Montreuil has published a number of papers, chiefly on marine parasites, and is currently working with Dr. Carleton Ray of the Aquarium staff on a study of nutrition and growth in young Hooded Seals. He has had considerable experience in collecting Atlantic phocids, part of it in association with Dr. Ray for the New York Aquarium.

Bell to Curatorial Staff

Joseph Bell, Head Keeper of Birds since 1957, has been appointed Acting Assistant Curator of Birds. He became a keeper in the Bird Department in 1942; an account of his initiation into the duties of bird-keeping appears on page 90 of this issue of *Animal Kingdom*. Andrew Winnegar replaces Mr. Bell as Head Keeper of Birds.

"Pili-pili" Arrives

A handsome young male Mountain Gorilla arrived late in May from the Antwerp Zoo. He is about six years old, weighed 156 pounds on ar-

rival, and appears to be in perfect health. His name, bestowed in Antwerp where he was kept for nine months, is "Pili-pili," a Swahili word for a very hot pepper. His disposition does not match his name, however, for he seems to be of a most tractable and friendly nature. For the present Pili-pili is in quarantine in the Animal Hospital but we hope to have him on exhibition before the end of the summer. He is intended as a mate for our female Mountain Gorilla, "Sumaili."

"The Llanos" Is Opened

Looking toward the creation of a very large South American exhibit in the northwest corner of the Zoological Park, a "Llanos" exhibit was created this spring on the site of the old goose paddocks north of the great Flying Cage. A stream running through the area has been diverted into marsh-like channels, grass grows luxuriantly, and the bird and reptile exhibits are attractively and naturally displayed. Thirty-two birds of 14 species have already been introduced, including spoonbills, screamers, lapwings, ducks and geese, and the Reptile Department has contributed three Rhinoceros Iguanas and three Common Iguanas.

Cattle Egret Seen in Zoo

An African Cattle Egret was seen sitting on the Bird House roof on May 10, the first sighting in the Zoo and probably the first in the Bronx. The bird belongs to the heron family and in Africa it follows such animals as elephants and rhinoceroses to eat insects stirred up by them or to feed on insects on their backs. In recent years it has migrated to South America, where it is now well established, and has worked its way northward into the United States and up into Canada. Unlike other herons, it is not found in a swampy habitat, but rather in open pastureland.



“Ardetta” and “Nerissa”

A female calf was born to our pair of Wisents, or European Bison, on July 11 and, in accordance with the rules for registering births of this rare animal, has been named “Nerissa.” (The first two letters of the name of any calves born here must begin with “Ne,” signifying that they were born in the New York Zoological Park collection.)

The parents of little Nerissa, named “Aristo” and “Ardetta,” came to us in 1959 from the Amsterdam Zoo (Artis) collection, where they were born in 1957. Their first calf, born here in 1961, was stillborn.

Wisents have been extinct as a wild species since the end of the last century and there are about 200 of them now, all in zoological parks or European government reserves. All are registered in the Stud Book of the European Bison.

PUBLICATIONS OF INTEREST

ORANG-UTAN. By Barbara Harrisson. 183 pp., 26 photographs, 5 drawings. Doubleday & Co., New York, 1963. \$4.50.

Barbara Harrisson and her husband, Tom Harrisson, who is Director of the Sarawak Museum, are fierce and vocal champions of the Orang-utan, whose numbers are declining alarmingly. They have had a great deal of experience with these appealing animals, both in the wild and as guests in their home — youngsters confiscated after illegal capture — and Mrs. Harrisson writes of them with sturdy partisanship that is all the more telling because much of her work has been aimed at preparing the orphan Orangs to be returned to the wild.

THE GREEN TURTLE AND MAN. By James J. Parsons. 126 pp., 58 ill., mostly photographs. University of Florida Press, Gainesville. 1962. \$8.00.

Dr. Parsons, a geographer at the University of California, has produced a historical, sociological and zoological study that is of interest to professional herpetologists, conservationists and the general public. Approaching the study of a single species (*Chelonia mydas*) from so many directions gives an over-all perspective that is seldom approached by the workers in any of these fields.

The historical summary of man's past relationships with the Green Turtle is followed by accounts of its present status and future outlook in various parts of the world. Dr. Parsons' fortunate relationship with Dr. Archie Carr and other members of the Caribbean Conservation Corporation (an organization devoted to the restoration of the Green Turtle to its former numbers and importance) has added immensely to the clarity and detail of the study. Most of the photographs were derived from Carr's work on the Green Turtle in the Caribbean. — H. G. D.

THE BIRDS. By Roger Tory Peterson and the Editors of *Life*. 192 pp., photographs. Time, Inc. (Life Nature Library), New York. 1963. Price \$3.95.

This is a happy addition to the *Life* “Nature Library” and to the growing number of general books on birds. If “The Birds” had not a single word of text, its amazingly beautiful and world-wide compilation of photographs and illustrations would earn it a place in the library of anyone interested in the world about him. Its photographs cover scenes from South American Rhea round-ups and North American goose banding to flamingos in France and penguins in the Straits of Magellan. This book is not to be compared with Gilliard's “Living Birds of the World” or Austin's “Birds of the World,” which are large, startlingly complete books with scores of family and species descriptions; it is, rather a review of the bird world and what makes it tick. Its chapters scan evolution, flight, food gathering, populations, etc. Dr. Roger Peterson and the Editors of *Life* are to be complimented on an exceptionally well-written and beautifully presented popular review of the Class Aves. — W. G. C.

THE REPTILES. By Archie Carr and the Editors of *Life*. 192 pp., 136 ill., many in color. Time, Inc. (Life Nature Library), New York. 1963. \$3.95.

The bright and dramatic photographs that the editors of *Life* have collected from around the world are matched by the equally bright and stimulating style that is Archie Carr's trademark. A great many basic facts of reptile existence and a huge number of interesting and unusual facts of their day-to-day activities are clothed in a delightful narrative text.

The many personal observations and first-hand accounts serve to illuminate what might in other hands have been a lengthy and dull catalogue of reptile history and natural history. Lest the uninitiated be fooled by the bright colors and light touch, let me mention that Dr. Carr, Research Professor at the University of Florida, is a professional herpetologist — and a good one. I know of no better or less painful way to obtain a clear and accurate view of the world of reptiles and their life's problems. — H. G. D.

THE CALL OF THE MANEATER. By Kenneth Anderson. 274 pp., 2 maps. Chilton Books, Philadelphia and New York. \$3.75.

The mankiller, be it tiger or rogue elephant or some other aberrant beast, is the only simon-pure villain of

the animal world and its hunting to destruction is a legitimate source of thrills even to those of us who would like to see animals shot only with a camera. Mr. Anderson's tales of hunting maneating tigers and a mankilling elephant in India are guaranteed to thrill.

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What's Happening Among the Lemurs?

IF ANOTHER FERRY doesn't sink at Ihosy, cutting off all access from Amboasary and the whole south of Madagascar from Tananarive, we ought to be hearing soon from Miss Alison Bishop. She is now in Amboasary and we hope she'll write Members a Newsletter about her studies of lemurs in their natural habitat.

It isn't too easy to study Lemurs, and even a keen and dedicated observer like Dr. Bishop will have her troubles. For one thing, only two of the species she'll be watching, the Ring-tailed Lemur (*L. catta*) and one of the Sifaka Lemurs (*Propithecus verreauxi*) are diurnal and they are hard to see, even in the "open" forest. Other nocturnal species can be seen only at early dawn or evening, but that may be an advantage after all, because the temperature in Malagasy during the daytime can rise to insufferable heights.

Miss Bishop got interested in lemurs from her research work in Yale's Primate Laboratory. Since lemurs are only found in Malagasy, which is a long way from New Haven, she asked for and obtained Society support for the field work. She has been studying lemur behavior under natural conditions, taking motion pictures and assembling those copious notes so essential to any basic natural history field work.

We expect her Newsletter sometime in September, and we're sure it will be as interesting as it will be unusual. The letter will be mailed to Members and friends of the Society, and Members are cordially invited to send us the names of people who would also enjoy receiving it. After all, a chance to get a first-hand report on what's happening among the lemurs doesn't come along every day.

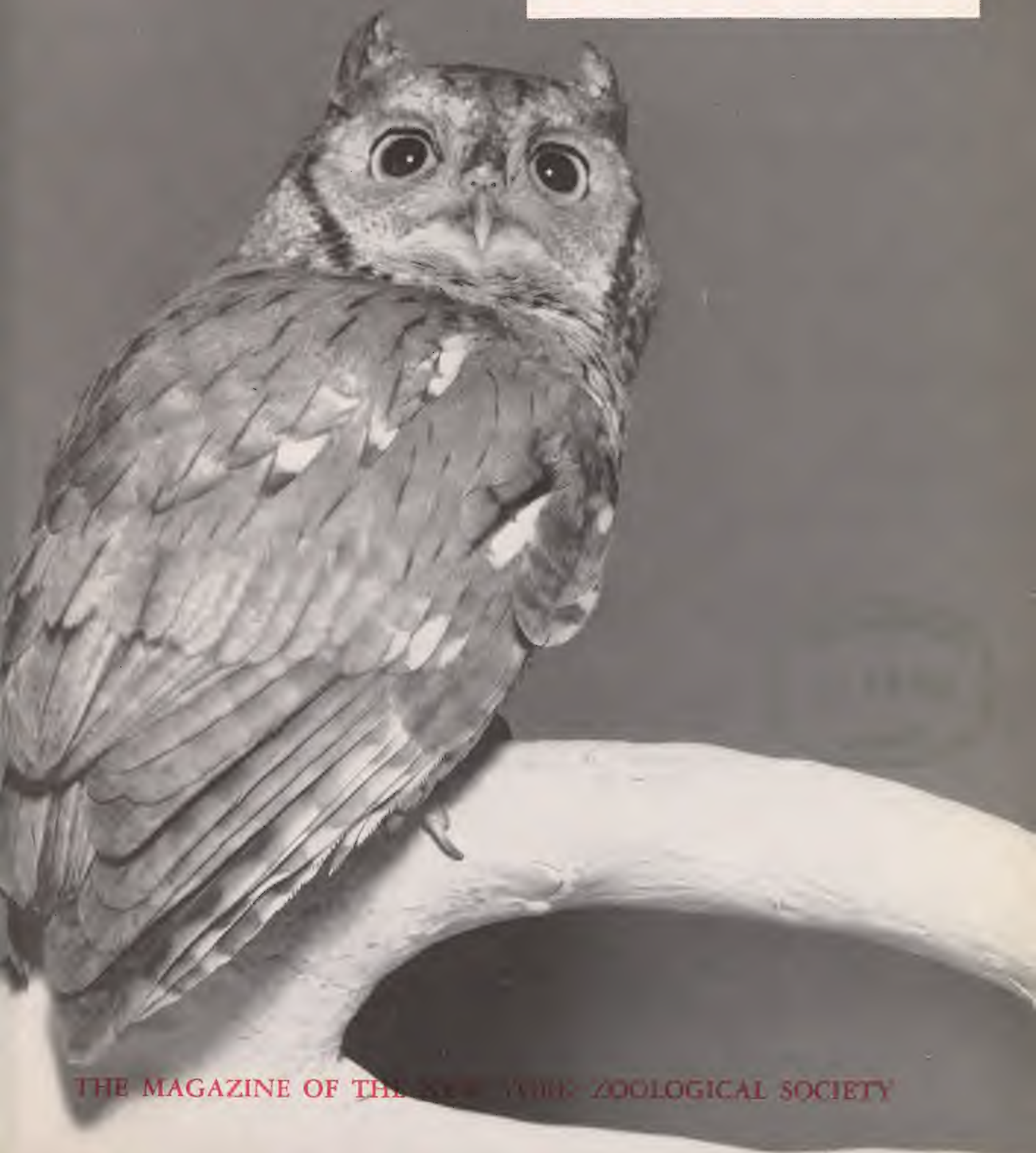
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ANIMAL KINGDOM



THE MAGAZINE OF THE NEW YORK ZOOLOGICAL SOCIETY

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ANIMAL KINGDOM

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The Enigma of Animals

EXPERIENCE in the handling of wild animals teaches one sure lesson: it is difficult and often impossible to predict what animals may do when faced with a new situation. This fact was brought forcibly home recently when our two Lowland Gorillas were introduced to each other. As the first article in this issue of *Animal Kingdom* makes clear, the human observers of the introduction were not the only ones who were surprised. Things did not go quite as one of the animals evidently expected.

A corollary lesson that Zoo people learn early in their careers is to expect the unexpected — and to be ready to meet the situation, whatever it may be. The preparations made for the meeting of Mambo and Oka were carefully conceived, and they were successful; a difficult operation came to a happy conclusion because nothing was left to chance. The next time a similar situation arises — as it will, presumably, with our two Mountain Gorillas — the small imponderables may be quite different, requiring a different set of precautions. For animals will always be themselves, and animals are as different as people.

Fairfield Osborn

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OCT 14 1963

Lowland Gorilla Introduction:

"Oka, this is Mambo"

By JOSEPH A. DAVIS, JR.

Curator of Mammals

IN THE ANIMAL BUSINESS, maintaining the status quo has special temptations. True, the management of animals in a zoological park — like any other enterprise — makes progress through experimentation and the trying of new procedures after careful consideration of the possible consequences, but the drawback is that animals are sometimes extremely conservative and not interested in change and progress. Hence, when you have a good thing going, you think long and hard before you upset the applecart.

On the other hand, often a little daring pays handsome dividends . . .

Thus we were of two minds last spring when, unexpectedly, the Antwerp Zoo offered us a male Mountain Gorilla, six years old, in late adolescence and perfect health. We already had a pair of gorillas living in relative harmony together: Mambo, a large male of the Lowland race, and Sumaili, a female of the Mountain form. Housed separately, we had another Lowland Gorilla, a female named Oka. Reviewing our collection, it was tempting to leave matters as they were, for manipulating gorillas is ticklish business.

But there is always an "on the other hand." On the other hand, if we acquired the Antwerp Mountain Gorilla, we could form two pairs: two Mountains, two Lowlands. It took us a while to conclude that this was an occasion when a little daring should be invested.

The Antwerp gorilla, a magnificent animal who had been named "Pili-pili" (the Swahili name of a very hot Congo pepper) in the Belgian zoo, arrived on May 15. Like every other primate destined to go into the collection, he was placed in strict quarantine in the Animal Hospital. Here he would undergo a careful check for parasites and a test to make sure he carried no infec-

tion of tuberculosis. Although he came from Antwerp with a clean bill of health, such a quarantine is a matter of routine and exceptions are never made. Further, the quarantine period would give us time to get acquainted with our new charge and learn whether he would, indeed, make a suitable mate for Sumaili. Not only that, but the time would be put to good use in separating Mambo from Sumaili and introducing him to his future mate, Oka. As things turned out, we did not lack for time; it took quite a while and some ingenuity to devise a method of administering a tuberculin test to the 150-pound Pili-pili. In the past, all our apes have come to us as babies that could be restrained in a practical manner, if not always easily, while a minute quantity of tuberculin was injected into the eyelid as a test for tuberculosis. A six-year-old gorilla, on the other hand, is impossible to restrain, and we were not willing yet to immobilize him with any of the new, but not sufficiently proved, drugs.

In the end, Dr. Gandal found a new device used to administer such tests to children, and we could at last stop thinking in terms of an eyelid injection. The device consists of a number of minute, short blades arranged in a circle about the end of a spring-operated plunger. Touch it to the arm of a child (or a gorilla), release the catch, and in an instant the blades, laden with tuberculin, have painlessly done their work. Over a period of weeks, Pili-pili was offered choice bits of food which he could get only by

When they are not circling and keeping a wary eye on each other, Mambo (foreground) and Oka manage to appear completely indifferent. If one moves, however, the other is instantly aware of a change.



reaching his arm out of the cage. Once this became an everyday procedure, followed without suspicion, Dr. Gandal merely touched Pili-pili's arm with the plunger and administered the test without the gorilla's being really aware of it.

As soon as the tuberculin test was shown to be negative we could begin to put into operation the plans that had been worked out over the past months. One object, of course, was to put together two pairs of apes of like subspecies; the "marriage" of Mambo (Lowland) and Sumaili (Mountain) had been one of convenience — they had been young and close in age — and there had been no potential mate of the proper subspecies for either at the time. Now we planned to "divorce" them, to put Mambo with Oka so as to have a Lowland pair, and then in due course to put the two Mountain Gorillas, Pili-pili and Sumaili, together.

We knew a good deal about the temperament of both Mambo and Sumaili, for the two gorillas had spent virtually all their waking hours together over the past ten years, being separated only at night, and at feeding time, when Mambo tends to be quarrelsome and something of a Dog In The Manger. He had always been the dominant animal, at least since he reached maturity, and on two occasions in the past five years he had injured Sumaili, once striking her chin with an uppercut when her tongue was out, causing her to bite off the tip, and on another occasion opening a gash in her arm with his teeth. Gorillas are physically durable creatures and Sumaili recovered quickly from each attack, the first of which, incidentally, was a semi-playful clout of the type that Mambo had been delivering for years. The second wound probably cannot be counted a real attack either, for had he so wished, Mambo might easily have killed the female.

Such outbursts as these appear to be common among wild gorillas, and George Schaller, in his book, "The Mountain Gorilla," reports that when a male begins the display that seems to be a release of tension, other gorillas move away out of reach. Captive-reared gorillas do not usually perform all the components of this display, so the warning is not always there to be heeded. At any rate, Sumaili often heeded the first signals and retreated, and Mambo, like a wild gorilla, normally struck an inanimate object at the climax

of his outburst. Sumaili respected him. We expected her to adjust to her intended mate, Pili-pili, when the time came, partly because she had learned respect for a male, and partly simply because she was used to the presence of another gorilla.

We expected Mambo to accept Oka for much the same reasons. He had been accustomed to Sumaili as a cage-mate, and showed no fear of her. But Oka's past had been different. She has lived a solitary life since her intended mate, Makoko, drowned in 1951.* Moreover, although Makoko treated her as Mambo has treated Sumaili, this would not be the first meeting between her and Mambo. Ten years ago, when Mambo was a 3-year-old and Oka already a mature animal of 13 years, they had been introduced. Those who were present report that Oka attacked Mambo, frightening him badly, and had to be forcibly separated from him. Would Mambo remember Oka after all these years? It was a possibility. He might be savage, so we needed a means of separating them if things became nasty. Accordingly, we investigated a new device, a fire extinguisher that shoots out carbon dioxide gas in a white cloud, with an accompanying loud noise. The gas is harmless under these conditions, and is, in fact, identical chemically with the gas all animals exhale in the process of breathing. In a test, Mambo was properly startled by the sound and sudden appearance of the white cloud, and so we added the fire extinguisher to our list of safety devices. Then we were ready to put Mambo and Oka together.

ONE WEDNESDAY MORNING in early August, as soon as the interior compartments of the Ape House had been cleaned, a small group of us arranged ourselves at the rear wall of the public space inside the building. Here, in the semi-darkness, we were not conspicuous, but could see all of Mambo's large cage and Oka's smaller one. Between them was the shifting cage, a door opening into each compartment, and at each door a keeper stood ready in the service corridor to separate the apes if it became necessary. Ordinarily there is no need for rapid coordinated action, but on this day a keeper in the corridor

* The Loss of Makoko. By Lee S. Crandall. *Animal Kingdom*, July-August, 1951.



carried a walkie-talkie radio, for the men operating the shift doors could not see the cage interiors well. With similar radio equipment in the public area we were able to direct the activity behind the scenes without disturbing the gorillas by shouting. These small portable radio transmitter-receivers had already proved useful in the Mammal Department, where Head Keeper Ruf and I are often far from a telephone much of the time, but in this operation they were invaluable. Another keeper, with a hose, stood out of sight of the gorillas, prepared to help separate them in case of a real fight. And, of course, we had the fire extinguisher in readiness.

The signal was given and two doors were pulled open so that the shift cage formed a passageway between the two exhibition compartments. We had decided after much thought to forego a long period of gradual introduction through a grille door.

Now the doors were open and we waited

Mambo begins a purposeful walk toward Oka that is likely to end in a rush that may or may not touch her. Despite her seeming obliviousness, she always knows what he is planning.

silently for something to happen. Mambo disappeared from sight into the shift, then reappeared in Oka's compartment. Without warning he rushed at her, punching. Sumaili would have cowered, but to our astonishment Oka punched back! Mambo was surprised and disconcerted. He stopped, and the worst was over.

The rest of the day followed a pattern of minor skirmishes. Mambo paced about with his lips pressed nervously inward together, every so often rushing at Oka to do battle with his fists. She frequently ambled out of the way and nothing further happened, but quite as often she met his attack with a quick blow and the onslaught would end. Many of Mambo's outbursts terminated harmlessly in a resounding slap of hand

Various scenes in the course of one of Mambo's rushes. He moves with great speed, but unless he definitely intends to bump into Oka as he flashes past, she can easily side-step and avoid contact. His excited rush subsides as quickly as it usually begins.



or foot on the wall. In fact, Oka paid no noticeable attention at all to many of his displays.

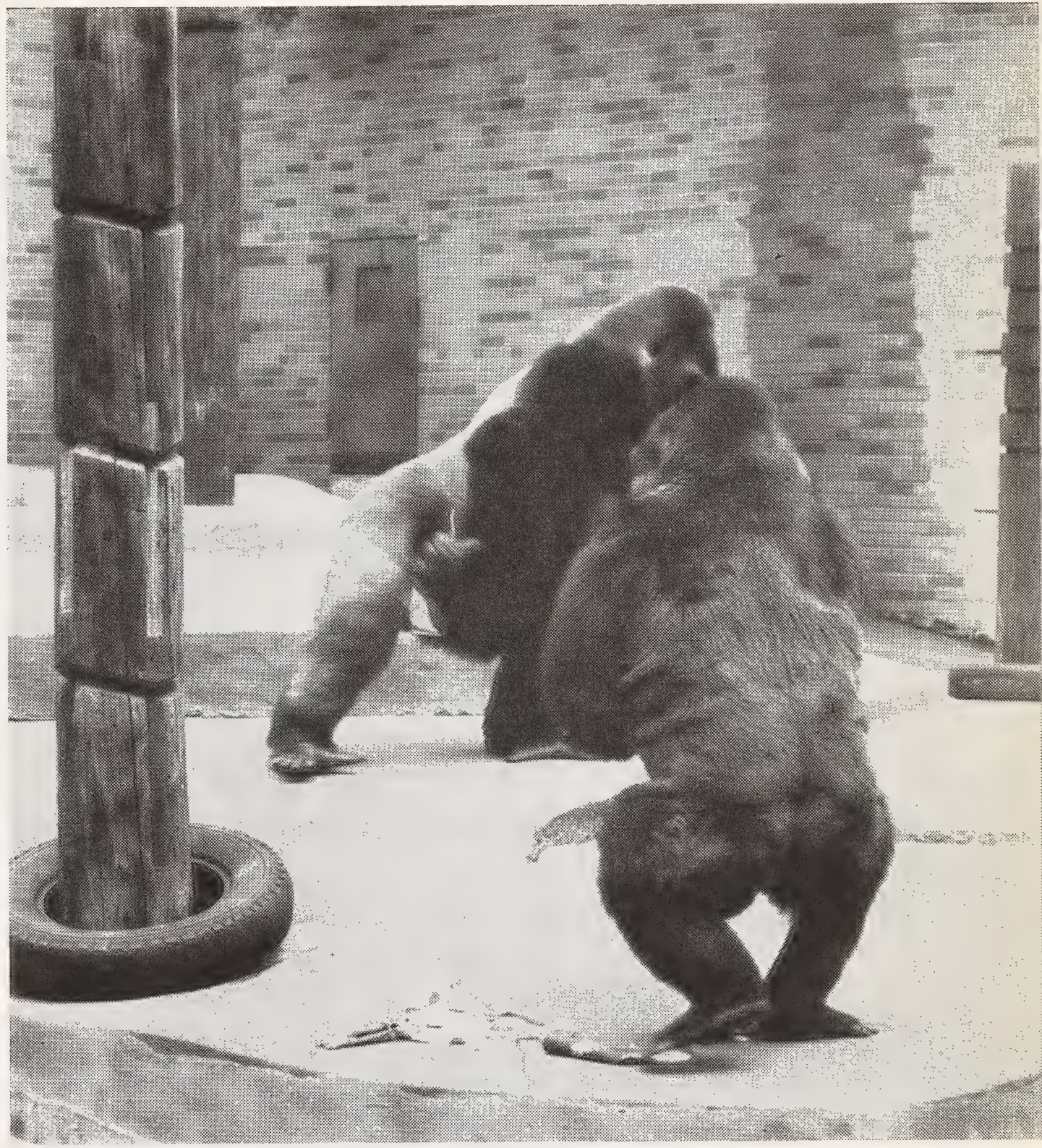
Interspersed between these encounters was another interesting facet of gorilla behavior, one which has counterparts among many other animals. Mambo would stalk toward Oka on a course destined to pass within a few feet of her. As he approached he elaborately turned his head away, avoiding a direct gaze; Oka responded by the same gesture of looking away, and both remained peaceful. This "looking away" is a common ritual used by animals with stereoscopic vision to avoid fighting. Animals with eyes at the sides of the head, and which see about equally well in all directions without turning head or eyes (rodents, ungulates), generally do not show this form of behavior, but those whose eyes are directed forward (most primates and carnivores) and are therefore capable of a fixed stare, do practice it. A direct stare is a dead giveaway of the animal's concentrated attention, and hence has a social significance, most often that of a threat or challenge.

On the afternoon of the first day we witnessed one tense incident, the only time an actual

wound was inflicted. Oka was the injured party, but the circumstances left us not too worried. She came away with a four-inch gash in the skin of her left forearm, similar to the one Sumaili had received from Mambo several years ago. But Oka had asked for it.

As we watched, she rose up on her legs and rushed at Mambo, who had been sitting quietly. Charging at him and hammering away at him with two balled fists, she backed him out of his compartment and nearly to the wall of her own. Mambo's mouth was open and in one of her blows Oka's arm glanced off one of his enormous canine teeth. She had inflicted the accidental wound upon herself.

As suddenly as it had begun the encounter was over and Oka retreated to examine her cut. Like a child with some tiny hurt, she gazed intently at the raw edges of the slash, licked it, touched it with a finger of the other hand. For the rest of the day she was absorbed in her injury. Happily, little bleeding occurred, and when we saw that the cut did not involve muscle we decided to let it heal by itself. We had followed the same course with Sumaili's cut, doing nothing except



to administer an oral antibiotic, for to restrain her would involve the very real danger of greater injury. Over the following days Oka's cut healed nicely.

After this incident, Mambo's demeanor changed completely. At the sight of the wound he withdrew, and for days afterward avoided whatever compartment Oka was in. New encounters were almost always initiated by Oka, who sought him out. As she entered Mambo's compartment he kept away from her and at the first opportunity slipped into the empty one. This sudden lack of aggressiveness had been noted before, when he reacted in the same way to Sumaili's injury. Although two instances of such behavior in a single ape are not firm evidence by any means, it is tempting to speculate upon them. Is such behavior, this loss of hostility at the sight of a wound, a further mechanism for avoiding serious fighting? A fight to the death is of rare occurrence among animals of the same species, and many behavior patterns have evolved in nature to avoid mortal combat. Could this response be one? The number of Mambo's outbursts did not diminish in succeeding days, but most were di-

rected at doors (the shift-cage door had to be repaired after three days) and walls.

A few days later the two gorillas were let out of doors into their moated enclosure, and with more space Oka and Mambo were calmer. Oka's lack of fear leads her to approach food thrown into their quarters while Mambo is feeding in the midst of it, something Sumaili did not dare to do, and things have settled down. The situation is as yet no more than an armed truce born of mutual respect, but the general consensus is that a steady improvement is taking place. Whether any real affection will blossom we cannot say, but then Mambo and Sumaili were never demonstrative either. Oka is 23 years of age, getting on in years for a captive gorilla, but no one knows with certainty how long gorillas live in the wild, or the upper age limit for breeding in females. The chances are that she is too old, and consequently we will be satisfied with a reasonably peaceful life together. But now we can proceed with the introduction of Pili-pili and Sumaili, our Mountain Gorilla pair. And then who knows? They are young together, and the chances are better.

*A Far-off Land
Close to Home—*

JAMAICA BAY WILDLIFE REFUGE

By JOSEPH BELL

Assistant Curator of Birds

THE EARLY SUMMER EVENING was clear, but quite windy, and we were thoroughly soaked by the spray when we pulled the boat up on the beach under a sky that was filled with birds, mostly Herring Gulls, swooping and screaming their protest. The island, roughly two hundred acres, was rather low and flat. Tall trees were few but there were several dense stands of black willow. Plummy phragmites grew in the lower, wetter, areas and coarse beach grasses covered most of the remaining surface except for some thick jungles of bayberry. The ruins of an old pier was the only sign of man's intrusion.

As we made our way up from the edge of the water the reason for the gulls' annoyance became apparent; they were nesting and we had to walk very carefully to avoid stepping on their nests. Eggs and gray-brown polka-dot young gulls were everywhere on the sandy soil between the clumps of grass, and within a few hundred square yards I noticed all stages from actual hatching to week-old chicks. The youngsters sat quietly as we passed, relying by instinct on their protective coloration. Then the tall stands of bayberry sud-



denly came into bloom as long white necks rose in alarm to observe us as we approached. Herons took to the air. Those white necks belonged to Egrets, both Common and Snowy, and rising in the air with them were Black-crowned Night Herons, Yellow-crowned Night Herons and Green Herons. A closer look at the bayberry revealed young Black-crowned Night Herons, almost fully fledged, in their streaky brown first plumage, climbing about near their nests in the lower branches. The Egret nests held much younger occupants and there were still many eggs to hatch. The sleek, black silhouettes of fourteen Glossy Ibis had joined the gulls and herons in the sky. We knew them to be new breeders here and did not think it wise to wait for them to settle again and attempt to locate their nests, for our purpose in visiting the Heronry on this fine June evening was to make only the briefest survey of the nesting activities with a minimum of disturbance to the nesters.

The island with its teeming breeding colonies cast a strange spell over us; it was like being in a different world, very far away. And this was indeed partly true, for we were far away from our normal paths of everyday experience, even though we were not very far from home. Wild as it was, our little island was not all it seemed at



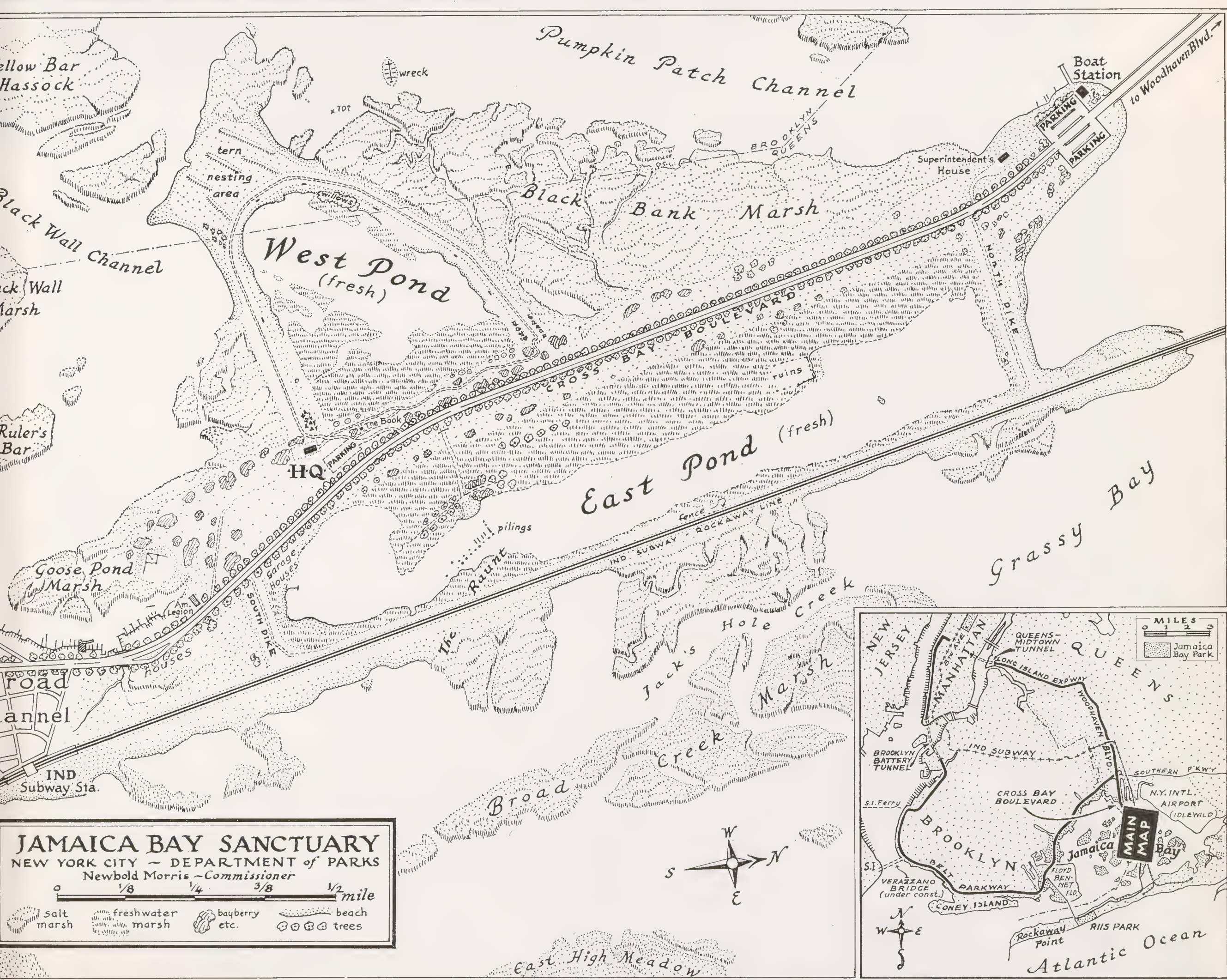
first glance, for much of it had been created by sludge dredged from under the water. Topsoil had been created chemically and it had been replanted very carefully with an eye toward the role it now plays.

Not to hide its identity any longer, the island was Canarsie Pol, and it is part of the Jamaica Bay Wildlife Refuge, a bird sanctuary of more than twelve thousand acres, within the boundaries of New York City. My companion on the visit was Herbert Johnson, Superintendent of the refuge.

Lying along the south shore of Long Island, Jamaica Bay is like a miniature inland sea, with a number of low islands spread across its surface. A natural harbor, the Dutch used it as a seaport

Low, flat, naturally covered with plummy phragmites and beach grass, the islands in Jamaica Bay are an ideal sanctuary for waterfowl. This view looks west.

*All photos by Herbert Johnson
Map copyrighted by Richard E. Harrison*





before the development of Manhattan. Water fowl using the Atlantic flyway have for centuries stopped to feed and rest on the bay and other waters and marshes surrounding the city. The growth of the city has eliminated most of these marshes, however, and the remaining ones, including Jamaica Bay, became so polluted from sewage that very little natural food could be found there for the birds. This was the situation in the nineteen-thirties when the New York City Park Department, under Commissioner Robert Moses, presented plans to the city government for the reclamation of Jamaica Bay. Wildlife conservation was a prominent feature of these plans, with a large area set aside for a refuge. Real progress was only achieved after 1950. The completion of a series of sewage disposal plants around the bay helped to clear the waters of pollution and a fire that destroyed a spur of the Long Island Railroad that crossed the bay to Rockaway turned out to be a boon. The city purchased the old spur. The dredging required

With mechanized equipment, the Department of Parks planted grasses and shrubs as a means of luring birds back into the area. An enormous improvement was made in this way.

to repair the embankment for a new spur provided material for dikes to create two semi-fresh-water ponds for the refuge.

The larger of the two ponds, about one hundred acres, is on the east side of Cross Bay Boulevard. The pond on the west side covers about forty acres. With their creation the project was really on its way, but there was still much to be done. Experts from the Fish and Wildlife Service, the Linnaean Society and the New York Zoological Society were asked for their advice on ways to lure the birds back to the area. Eel grass, widgeon grass and sago pond grass were planted in the water to provide food for waterfowl. Beach grass was planted on the dikes to offer cover and hold the soil. Willow, poplar, Japanese black pine, Russian olive, *Rosa multiflora* and

Rosa rugosa were added as cover, food and nesting sites for land birds. A gravel path and some benches that offer a good view of the water make the west pond the most popular with people of all ages who come to watch the birds. A permit is required to visit the refuge but this can be obtained, without cost, by writing to the Department of Parks at the Arsenal in Central Park.

Everyone is pleased with the success of the planning, dredging and planting of the sanctuary but best of all it has been a success with the birds. A broad, fairly level, field between the freshwater pond and the bay on the west side is now used as breeding grounds by Least Terns, Common Terns and Black Skimmers every spring. Killdeer, Spotted Sandpiper and Clapper Rails nest along the sides. A pair of Woodcocks nesting in the refuge for the past two seasons were the first of this species reported nesting in the area in twenty years. If you visit the refuge at the right times you can follow the reproductive cycle of many species of waterfowl, from courtship through the rearing of their young. You can watch a male Ruddy Duck, resplendent in his rust-red nuptial plumage, point his spike

of a tail toward the sky and slap his bright blue bill against his chest as he swims around his lady love. Young Common Coots with bright red heads, and Pied-billed Grebe chicks dressed in stripes, never fail to startle, amuse and please even the most blasé bird-watcher. Black Ducks, Gadwall, Shoveller, Baldpate, Green-winged Teal and Blue-winged Teal all nest or have nested in the refuge. Thousands of waterfowl crowd into the bay in the fall and winter and birds banded here have been recovered as far away as Alaska, Michigan, Minnesota, Ontario, Newfoundland and Florida.

Many of the regular avian visitors arrive at the refuge just when they are expected each year, but there are always a few surprise guests dropping in for a snack or a few days' rest. A Ruff, a Yellow Rail, a Purple Gallinule and the Black-headed Gull seen there this summer all caused great excitement among the watchers. The rarest

Quick-growing, thick and tangled, Rosa multiflora and Rosa rugosa form windbreaks and provide food and shelter for many birds. Most of this kind of vegetation had to be brought in.





A Coot hovers her eggs on a substantial nest of grass stems and reeds. Below — Common Egrets and Snowy Egrets haunt the dense thickets of bayberry which grows naturally.



visitor so far appeared at one of the feeders on February 21, 1959, and stayed for five days; scores of bird-watchers came to see the European Redwing, *Turdus musicus*, for this was the first official record of the species in North America.

Bird watching, during the clement weather of spring and summer, is pleasant and relaxing but only the hardest enthusiast makes the pilgrimage when the icy wind whistles across the frozen marsh. You make your way along the path, wondering why you were crazy enough to venture forth on such a day — and suddenly several hundred Brant rise from the open saltwater far out in the bay. Or you spot a Snowy Owl, barely visible as he sits on an old piece of timber, and you feel just a little bit warmer.

Today most of us are interested in, or at least aware of, wildlife conservation, but all too often the term conjures up visions of Alaska, Canada, the threatened big game herds of Africa — all far away lands. The Jamaica Bay Wildlife Refuge is one of these far off lands, but close to home.

Fish Cleaning Done Here

By CHRISTOPHER W. COATES

Director, New York Aquarium

AMONG FISHES there are many odd habits, some duplicated in terrestrial animals, some not. Certain fishes have apparently chosen the career of professional cleaners.

Since the advent of skin diving, many such cleaner fishes have been observed in action, assiduously swimming over the bodies and fins of larger fishes, carefully picking bits of skin or other attached particles. They enter the mouths of the larger fishes, which obligingly open for them, work through the extended gills until the larger fish has had a thorough grooming. It even seems as if they pick parasites from the skin of the cleaned fish.

Some other creatures do the same thing; certain shrimps have been seen doing it.

Apparently fishes living in the habitat of these cleaning fishes, the tropical or subtropical seas, know of this service and line up at the rock or coral formation near which the cleaning fish has set up shop, patiently awaiting their turn to be cleaned.

Although we know about such peculiar behavior and sometimes can get the fish, it is difficult to make a good working exhibit of it for the observer will usually miss the operation or the cleaned fishes become so clean there is no

Two Neon Wrasses show up against the body of a Green Moray; they cleaned the teeth and jaws of the moray but paid little attention to its body, covered with a coating of mucus.



The Nassau Grouper and the Neon Wrasse come from different seas, but the grouper reacted to the Pacific fish just as it would to cleaning by fish of the Atlantic.



profit for the cleaner in continually working the fish over.

We have a tank sixteen feet long inhabited by two Green Morays seven feet or so long, and a number of groupers of various kinds, including Scamp, Nassau and Black Groupers and Tiger Rockfish. These are all large fishes, ranging up to forty inches in length. They were caught in Bermuda or Florida; all are from the Atlantic. They all eat fish as a basic diet and any new fish within range is swallowed immediately.

Recently we received a small collection of Neon Wrasses, *Labroides dimidiatus*, from Hawaii. These are known to be cleaning fish. They reach about three inches long. Our specimens were a little over two inches long.

We wondered if the groupers, which had undoubtedly been subjected to the ministrations of Atlantic cleaning fishes before they were caught, would react in any way to the introduction of a Pacific cleaning fish which they could not possibly have seen before.

There was the risk that the little fishes would be eaten before their good intentions were discovered but we decided to take a chance. Two Neon Wrasses were gingerly introduced into the tank.

The results were astonishing. Within five minutes all the groupers were lying on the bottom of the tank, mouths wide open, gill covers extended, and all lay quietly while the tiny wrasses swam over and under, in the gills and out the mouths. We immediately put eight more of these

cleaners into the tank and every large fish was cleaned from head to tail, mouths, teeth, gills.

Even the fierce morays opened their mouths and had their jaws and teeth cleaned, although the wrasses paid little attention to the body of these long creatures, for they have a thick coat of mucus over the skin and this did not seem to interest the cleaners at all.

How the original inhabitants of the tank recognized the potentials of the tiny Neon Wrasses, which do not look like their Atlantic relatives at all, seems inexplicable unless there is some characteristic behavior pattern common to all the cleaning fishes that is immediately recognizable by other fishes.

We have introduced these cleaners into many tanks now, with a great variety of fishes, big and small, and none have ever been eaten. At least, all we put in are still there except that one is missing from the original tank. We suspect it went through the overflows to the filters.

These cleaning fish are specifically stated to take external parasites from the skin of their "customers," but the anatomy of at least some parasites would make this seem improbable. Nevertheless, all the fishes subjected to these wrasses seem quite clear of any external parasites — which we are not always able to eliminate by acceptable treatments. Even the eyes of the groupers, a notoriously good hunting ground for parasites, are clear; the fish lie patiently while the little electric blue and black cleaners work right over the eyes.

ANIMAL NEWS IN PICTURES

Photographs by SAM DUNTON

Staff Photographer



There is no doubt about it; "Gracie" is growing up. Gracie is the Takin — the only one in the United States — that came to us from northern Burma three years ago this fall. At that time she weighed 155 pounds; we have not been able to weigh her since, but she remains fairly tractable and her damaged right horn shows little sign of the injury it suffered while she was still in Burma.



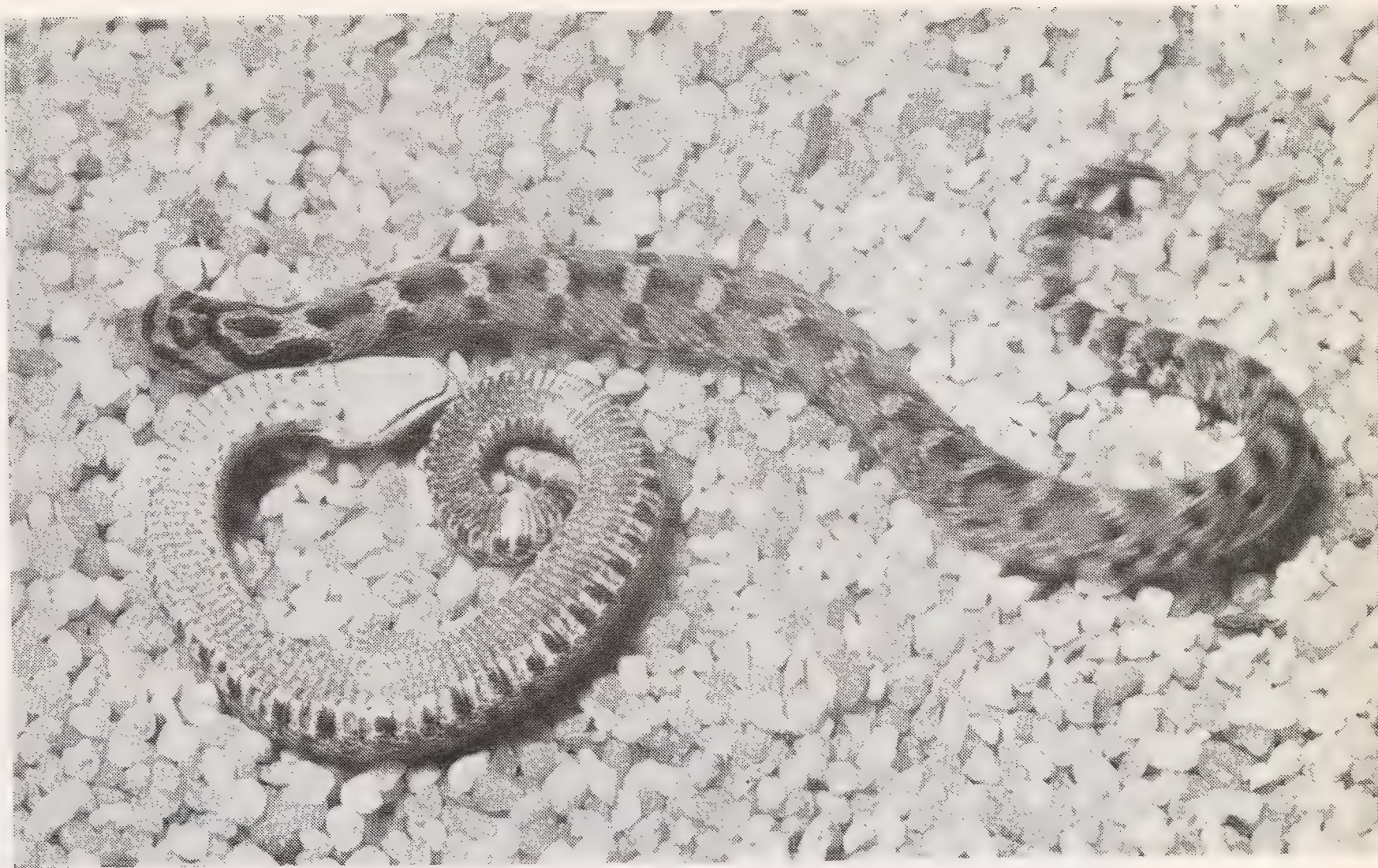


This young Ribbon Seal at the Aquarium is rare in captivity — in fact, it is the only one in the United States. It was captured last spring in Alaska and brought back by Dr. Carleton Ray of the Aquarium staff. Now it is thriving in an out-of-doors pool which it shares with Ringed, Harp and Siberian Seals.

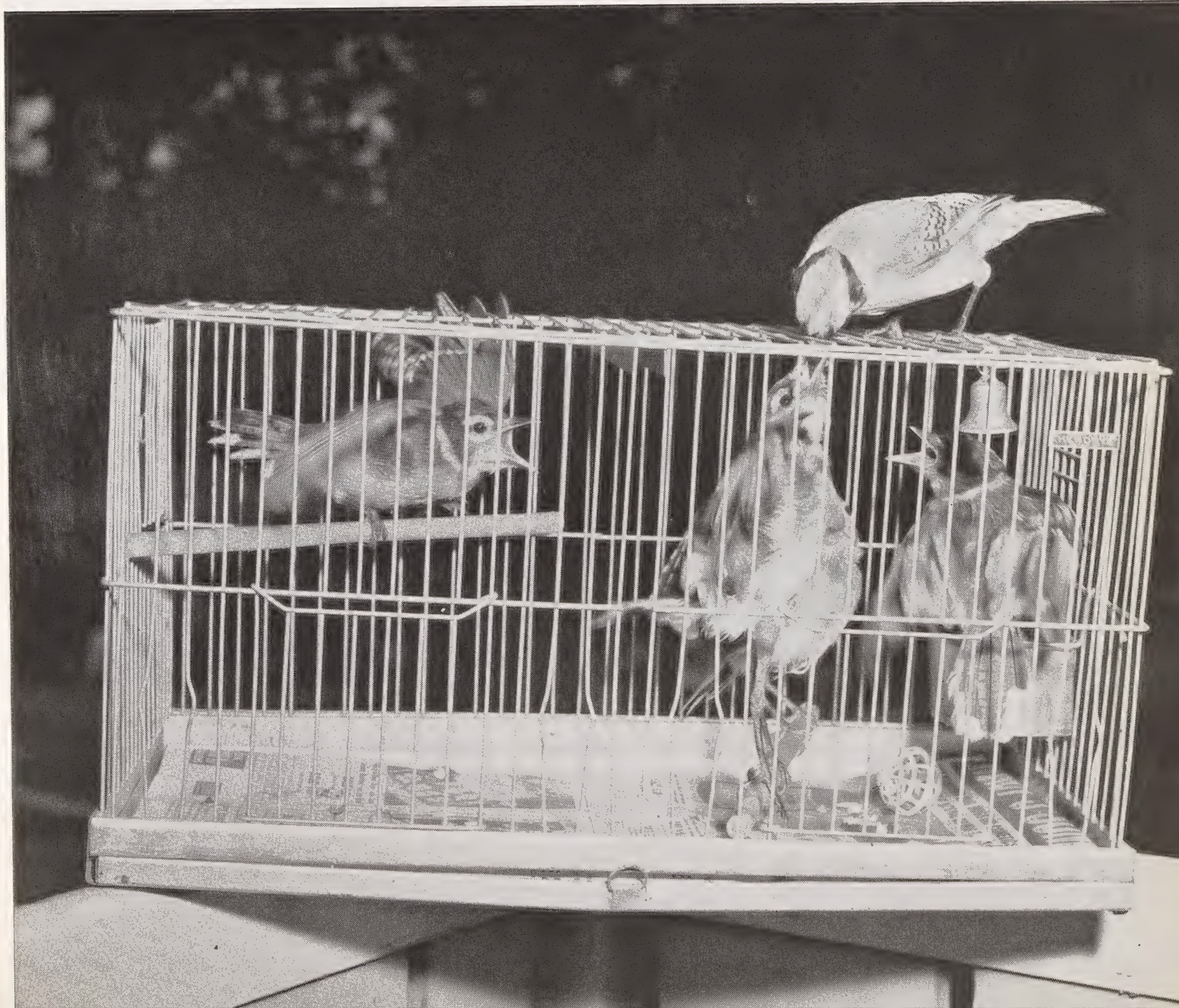


In the normal course of things, an Andean Gull and a Silver Gull would be unlikely to meet — except in a zoological garden — for the Andean comes from the high Andes of South America and the Silver from the coasts and harbors of Australia. However, they did meet in our Flying Cage, and this alert and hungry chick is the result.

The Hog-nosed Snake (*Heterodon platyrhinos*) is famous for its habit of "playing dead" when disturbed. It is an inborn behavior pattern, for when 40 Hog-nosed snakelings were hatched in the Zoological Park in late July, they "played dead" a few minutes after emerging from the egg. Within a week they were accustomed to disturbance and were not willing to react so readily.



The Children's Zoo got an unexpected and very welcome assist in the feeding of four baby Bluejays this spring. Three were brought in by visitors, the fourth fell from a nest in a tree overhanging the Children's Zoo. When it was put in this cage its parents came down and fed it and soon "adopted" its companions, working assiduously to feed all four. When they could take care of themselves, all were liberated and they flew off with the old birds.



*A Bundle of Fun,
Pep and Power—*

The Self-Confident Ratel

By MISS S. K. SIKES

Formerly, Department of Zoology, Ahmadu Bello University, Nigeria

I HAVE READ few accounts of Ratels kept as pets or in zoological parks, and this is surprising, for if it is taken into custody in early cubhood the Ratel becomes a loyal, intelligent — if sometimes ferocious — pet. It is then that one can study so many of its startlingly apt adaptations to its way of life.

The Ratel (or Honey Badger) is known scientifically as *Mellivora capensis* and is one of the ornaments of the weasel family, the Mustelidae. Widely distributed though it is, throughout Africa and parts of Asia, specimens from the two continents are scarcely distinguishable one from the other, and all possess two important physical attributes: the presence of a gland which produces a strongly penetrating scent and (usually) a pelt with a boldly warning pattern.

Even from a very early age the inherent bravery of the Ratel is evident. A young female, "Andie," which I reared from the age of about two months, showed this tendency from the first. Usually a recently-captured wild animal of any age will cower or move away if startled, but the Ratel's reaction is well illustrated by an incident that happened about the third day that Andie was with me. She was playing around my feet while I held a cup of tea in my hand. The spoon fell near her with a clatter. Instead of withdrawing, Andie rushed forward, making her angry, grating growl, and attacked it viciously. After that I tried experimentally with all kinds of "enemies," animate and inanimate, to startle and frighten her, but never once in all the time she was with me did she hesitate to rush forward to scare off, and if possible attack, the offender. She used to follow me "at heel" like a dog, trotting eagerly along,

cantering to catch up if necessary, and occasionally pausing to dab musk here and there from her anal gland. On various occasions, when crossing open ground, Andie was mobbed by kites swooping down; she would pause, one paw raised and tail erect, and stare up at them arrogantly, "grating" warningly at them. They never dared to come within range of her teeth and claws.

Both by day and by night the Ratel is conspicuous. Even the starlight of a moonless African night is sufficient for a person to see comparatively clearly in "bush," and the white upper surface of the Ratel seems all too visible, positively gleaming, as it pads along. To most nocturnal animals it must be even more obvious than to human beings. The deliberate dabbing of musk along whatever route it follows also proclaims the Ratel's presence vividly, and the scent is readily detectable even to the human nose. Both the arrogant gait and the boldly advertised color and smell suggest a thoroughly self-confident animal. One may well ask upon what, in so small an animal, such self-confidence is based.

The fully mature Ratel grows to about a yard in length. It is endowed with certain features which render it practically accident-proof and fatigue-proof, hence unbeatable! In the first place, it is protected by an unusually thick skin, loosely covering a long, low, highly mobile body. So loose is the skin that, if gripped by the scruff of the neck, the animal can twist around inside its own skin and deliver a first-class bite on the wrist of the hand holding it. It can also carry out a to-and-fro jerking movement (apparently independently of the skin) whereby it can frequently free itself. Cuts or gashes in its skin can be made

only with great difficulty, and many accounts testify that even the bites of large dogs seem to make no visible impression.

Its tenacity is remarkable. Once it gets a good grip with its teeth, it seems that nothing will make it relax. On one notable occasion a tame Ratel "attacked" a sack with which I was teasing it and obtained a good grip. It held on for nearly 30 minutes, while I held the sack and swung it round and round and back and forth, and actually beat it hard on the ground. I repeated this game on numerous occasions but usually per-

suaded the Ratel to disengage itself sooner by dropping the sack and going away. It would then shake the sack a few times and either drop and forget it, and follow me, or else carry it away to its lair. Closely connected with this tenacity, and probably responsible for it, was a characteristic build-up of ferocity. I imagine that there must be an unusually large release of adrenaline immediately an attack is initiated, for the build-up may reach such proportions that the eyes seem to blaze, the mouth foams, all the hair stands on end and the teeth and claws swoop in furiously



Although he was banished to an indestructible compartment in the Kangaroo House very soon after his arrival from Liberia, "Lollypop," our Ratel, has remained friendly and interested in people. Here Mrs. Adrienne Zeidner of our Photographic Department renews acquaintance with Lollypop several months after he left the Animal Nursery because of destructiveness.



accurate swipes. Even its nearest and dearest (who, at other times, may be overwhelmed with affection and loyalty, being smothered in musk to prove it!) are no longer recognized and become the objects of determined aggression. Throughout the build-up of ferocity, the grating snarl never ceases, even if it may become a little more breathless as times goes on. When all is over, and the foe is vanquished, the Ratel "runs down" again fairly quickly, giving only an occasional half-hearted snarl and grumble. After about a 10-minutes' nap, it becomes as calm, gentle and able to be fondled as any bumbling puppy.

The handling of a Ratel during its fury-periods requires some skill, and the handler soon devises a suitable technique. I found that I could distract its attention with my left hand and, with a lightning movement of my right, grip the skin on the back of the head — *not* the neck. Even the long-reaching claws could not dislodge this grip, and the head could not be twisted sufficiently to bring the sharp teeth into action, although, if the grip was not secure, by jerking sharply the animal sometimes managed to get free. Any successive attempts at grabbing would then be progressively more difficult.

The long and heavily-clawed feet are a most expressive feature of the Ratel. They are bear-like and very mobile. A tame Ratel will amuse

A young female Ratel in typical alert stance. The bear-like, heavily-clawed forepaws are noticeable, as well as the bright eye, in-tucked ear and erect tail as she stands to attention.

Photo by the author

itself for hours carrying out manual experiments. If given a wooden box with holes in it, and some small pebbles, the Ratel will "study" how to drop the pebbles into the box, and then how to get them out again. It may put one paw inside, at the same time peering in through another hole to see if it can get hold of the pebble inside. There was a period when for days on end Andie played with the brake-drum of an automobile. It had interesting holes in it, including the shaft hole. Also it was too heavy for her to lift. Not only did she discover how to *roll* it in order to shift it to a new place, but also how to lever it up with a piece of wood, so as to get an arm underneath and turn it right over.

The paws are also used for holding down prey, assisting in capturing live food (*e.g.*, small birds), or gripping meat or bones during feeding. They can scoop up syrup or honey in the cupped palm, or equally well act as shock-absorbers after a jump down from a height. The claws are used for digging in soil or as a sort of tire-lever or lid-lifter. This versatility poses a problem for anyone keep-

ing a Ratel in captivity: only a very strongly-wired cage will keep a Ratel confined successfully.*

In 1961 I kept a 12-foot python in a converted meat-safe in my garden. It was double-wired with 1/4-inch mesh coffee-tray wire, covered with gauze, and the wire was nailed to the wood and then finished with rounded beading. Inside, the python had its tree, nailed in place, a bath of water, and its "mezzanine" floor above for sleeping. One morning we found all the evidences of an attack by a fully-grown Ratel: beading prized off, gauze torn and pulled, doors strained and deep scratches in the wooden walls. Ratels are well known to enjoy eating snakes, and this one certainly made a fierce attempt to get my python.

Ratels like to urinate and defecate over a hole, and unless one presents itself ready-made, they will dig one specially. Sometimes they cover it over afterwards, but sometimes this courtesy is neglected.

* As the New York Zoological Park knows only too well! Last year Mrs. Dora Weyer of Liberia wrote us that on a recent visit to the Bronx Zoo she had noticed a large, empty, strongly-barred compartment in the Kangaroo House and decided that it would make an ideal home for her pet Ratel. Would we like to have the animal? We would, of course, and "Lollypop" arrived some time later. He was so playful, friendly, eager to be with people, that it seemed a shame to deprive him of human friends abruptly, so the Curator of Mammals decided to take him home for a few days. The next morning he brought Lollypop right back to the Zoo; during the night the Ratel had peeled the paper off one wall as high as he could reach. Someone else volunteered to take the engaging creature home the next night; again Lollypop came back the following morning. He had opened a kitchen cabinet, knocked over bottles and ripped packages to shreds.

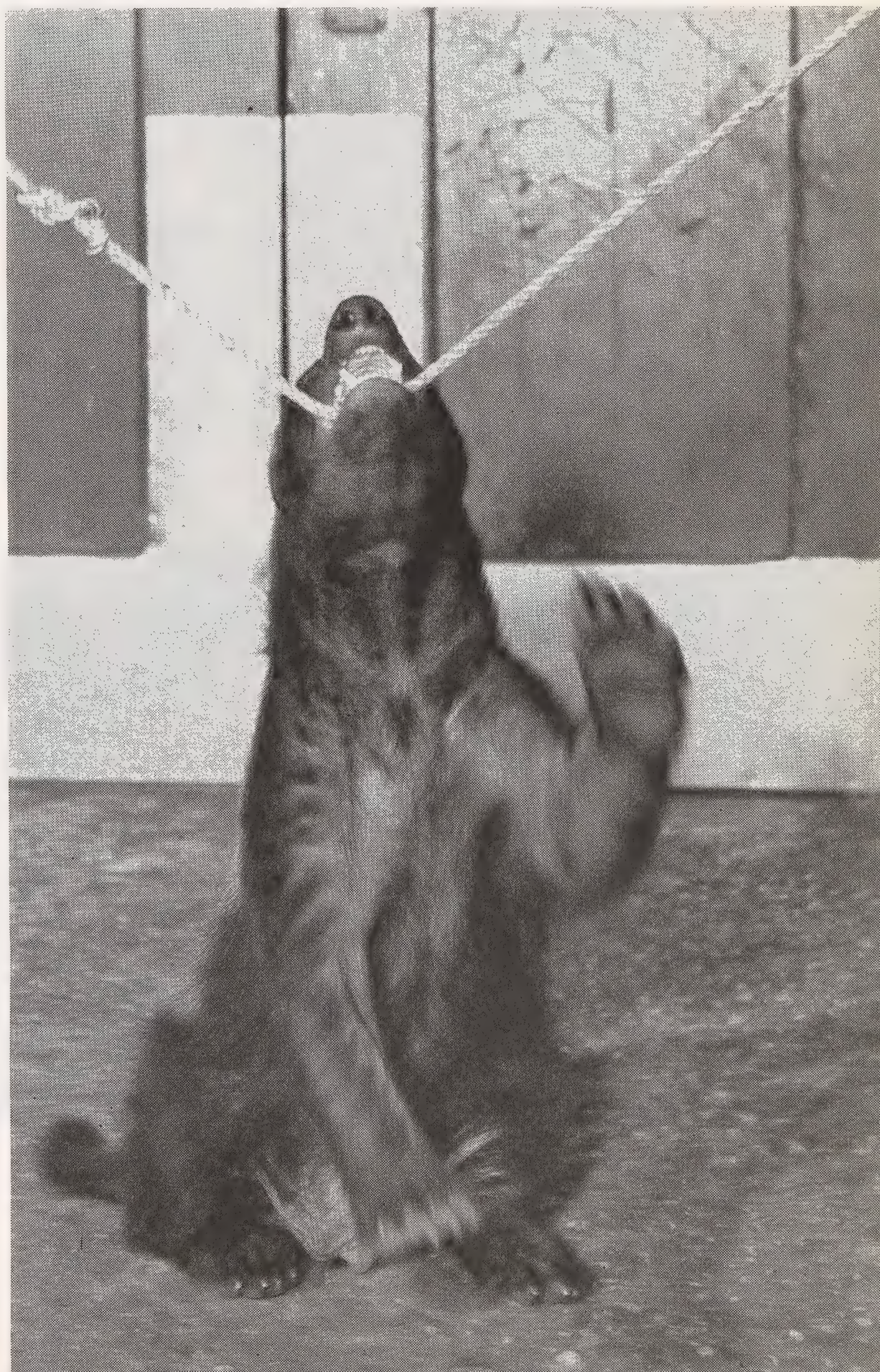
The new Animal Nursery then offered to take Lollypop and make him a star attraction. Forewarned, the personnel had a sheet of quarter-inch plexiglas bolted across the bars of a holding pen at one end of the Nursery. Four times Lollypop pried, tugged, scratched and scrabbled until he had broken out a chunk of plexiglas big enough to allow him to escape. What he did to the interior of the Animal Nursery while he was at liberty is beyond telling.

Lollypop now occupies the iron-barred compartment in the Kangaroo House that Mrs. Weyer had originally suggested for him. He has a replaceable log and an unbreakable tin bucket to play with and he is endlessly active and playful still—but now his destructiveness makes no great difference. — *Editor*

There is a good deal of bulldog temperament in a Ratel. Lollypop delighted in hanging onto a rope with his teeth, and Miss Sikes once swung a Ratel on a sack nearly 30 minutes.

Any hole in a tree is immediately investigated, and any loose bark pulled off and closely inspected for insects. Certain insects appear to be regarded as delicacies, for example certain brown grasshoppers, hawkmoths, male driver-ants and the like. Eggs are also enjoyed, and may be treated first as playthings, until they crack, and then the contents are scooped out. A young, growing Ratel thinks a whole dove about right for a day's meal, whereas an adult needs a full-grown fowl. After a good meal on a warm day, the Ratel, belly bulging and legs splayed widely, lies flat on its back and falls asleep. It strongly resists being awakened in these circumstances.

As with so many gland-bearing mammals, one wonders what is the real function of the scent. The Ratel has the anal glands typical of the Mustelidae. I have observed the emission of the secretion as a routine during foraging, when at intervals the animal dabs down its gland region on the ground and "paints" the places it chooses. When in a fury-mood the scent is very strong and the se-



cretion abundant. It seems to be a matter of human opinion as to whether the scent is "sweet," "pungent," "frightful" or "unbearable." Personally, I found it by no means unpleasant and got used to it as time went on. Perhaps the time of most abundant secretion is during the demonstration by a tame Ratel of "affection" towards its favored human or animal friends. In Andie's case, the puppies I had could elicit the scent, provided they nuzzled the Ratel *through* the bars of her box, not face to face. If I cuddled her on my lap or in my arms, she would pour out the secretion, painting my clothes and hands generously all the time. I have not kept a male and female simultaneously and wonder whether the secretion has a primary function in relation to courtship, as is true, for example, in the duikers, where the secretion from the facial gland is essential to the achievement of full coupling.

A Nigerian, familiar with our wild mammals here, told me that it is believed that Ratels only couple after feeding on honey from a hive. At first I was inclined to discredit the idea, but have since several times wondered if some stimulus to courtship is elicited either by the presence of the bees forcing a build-up of the scent secretion accompanied by a fury-reaction, or perhaps an equivalent sex-reaction based on hormone releases. It would be interesting to know whether any such trigger-mechanism has been necessary to success in breeding Ratels in zoos, and indeed whether Ratels have ever been bred in captivity.

The rippling, streamlined body of the Ratel seems to emphasize its indefatigability. The small, bright, beady eyes seem to be so fully alert and

yet so well protected that they appear to be perfectly adapted to remain unnoticed by the buzzing, angry bees. Likewise the intucked ears offer no "bitable" or "stingable" extremities. The skull, too, is thick and rounded, and resistant to apparently unlimited banging and thumping.

The sounds made by the Ratel are distinctive. The main one, used in different tones and at different frequency and pitch, is a rasping or grating sound, apparently made in the throat and modified by the tongue. It can be very expressive and from it one can soon sense the mood underlying the sound. The Ratel also makes sharp "barks" and "whines" on special occasions. For example, when Andie went through sentimental nest-building periods she was inclined to make soft squeaking and whining noises. If bored, and wanting a run outside, she sometimes "barked."

What is the natural "niche" of this forceful character of the forests, in the over-all pattern of the fauna? Is it just another predator? Is it really more than this, a vandal and a robber? There is no doubt that almost every other wild inhabitant of the Ratel's haunts respects and fears it. Even lions have been reported to withdraw with dignity rather than stand in the determined pathway of an approaching Ratel.

There is, however, another contribution which I believe this fierce creature makes, together with the other scent-producing animals. Each fauna-unit (*i.e.*, a naturally occurring aggregate of species characteristically sharing one ecologically localized area) has a strong mechanism whereby individuals and groups of that unit recognize the limits of their shared territory. Even young ani-



The Ratel leaves its scent mark on rocks and stumps as it moves about, dabbing them with a musk secretion from its anal glands.

Photo by the author

Playfulness is one of the characteristics of a Ratel, and when we provided a plastic ball as a toy for Lollypop, he played with it endlessly. The only thing he liked better was a tin bucket — perhaps because it made a lot of noise when he banged it around.



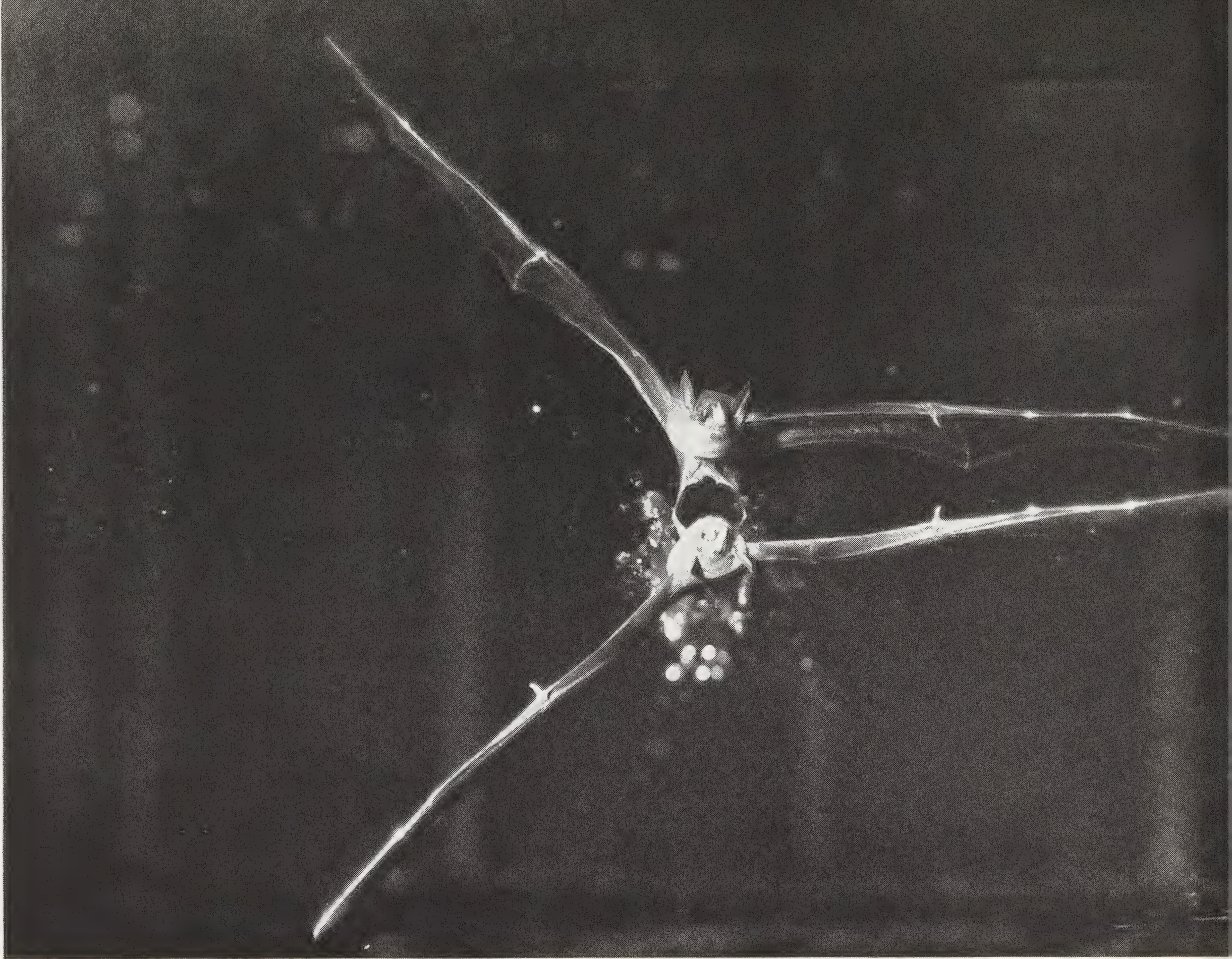
mals rarely set foot beyond such an area unless they are the young males just ousted from the parent herd or pride, or unless a mass-migration is in progress. It is as yet a matter of speculation only, but I am prepared at least to postulate that this area-recognition is possible through the scent concentrations resulting partly from the generalized urine-feces smells and partly, probably in a more lasting way, from the secretions of the gland-bearing carnivores, ungulates, rodents, etc., comprising a given fauna-unit. Only further research can show us what types of animals comprise a fauna-unit. Possibly mammals such as bats, monkeys, galagos and the like comprise arboreal fauna-units in a given area, the scent-concentrations occurring in the trees alone, while the carnivores, ungulates, ground birds, etc., comprise major terrestrial units, and rodents, lagomorphs and so on comprise minor terrestrial units. The concept of scent concentration areas will at once be seen as a possible explanation of the spontaneous recognition of game reserve edges even by second- and third-generation animals in some areas. It is a comparatively common experience to find game remaining in a game reserve, even though only written noticeboards demarcate the boundaries.

Perhaps it is not an unreasonable theory to suggest that the recognition of a new “safe” area established by the members of a given fauna-unit comes about firstly through the withdrawal of individual members from danger areas. Perhaps excessive hunting, or the increased presence of people (as in new settlements, developing farmlands) may cause the withdrawal of indi-

vidual animals and herds. Their scent concentration now increases in the safe withdrawal area and diminishes in the danger area. The individuals of the young, growing generation will not generally need to venture into the danger zone at all, but will, on reaching the limit of the scent concentration area, hesitate to venture on to ground bearing no fresh scent belonging to their own fauna-unit. Their tendency will be to turn back into their recognized area. Should such a “safe” or “withdrawal” area now be demarcated for protection, the recognition of the limits by the animals will normally become more marked. The tendency to overstep the boundary will then only result from a migration phase (when some force stronger than scent concentration alone urges the animals to move), the search for new territory by young males, the onset of abnormal climatic conditions such as drought, or floods, or by human interference.

If there is some basis for this theory (and probably the development of an effective scent-detector could prove it), then we should expect to find that the scent glands have a large part to play. The pedal glands on many antelopes, the facial glands of duikers (which they often rub on tree trunks and bushes), the anal glands of the Mustelidae, pangolins, etc., probably all contribute.

Perhaps, then, our roving Ratel is not only a vandal and a robber, but also a sort of mobile patrol, aiding in the efficient scenting of its fauna-unit area. If so, it should perhaps be regarded as one of the more independent and individualistic members of its unit.



The Fishing Bats of Trinidad

By DONALD R. GRIFFIN

Department of Biology, Harvard

FROM TIME TO TIME during the past three years bats have joined the birds, butterflies and fiddler crabs under study at the William Beebe Tropical Research Station in Trinidad. The unique facilities at Simla have enabled us to broaden significantly our earlier studies of the behavior, and especially of the orientation, of these nocturnal mammals that manage to excite such creepy popular emotions along with the sober admiration of physicists. Analytical scientists are impressed by the natural sonar or "radar" systems by which bats guide

their flight in darkness. But as is so often the case in biology, bat sonar is not a single, rigid system but a multitude of adaptable techniques of orientation by echo. These vary from species to species according to the orientation problems inherent in each bat's particular way of life. In temperate latitudes the bat fauna is merely an impoverished delegation hardly fit to represent the splendid spectrum of ingeniously adapted fliers that populate the caves and forests of the tropics.

The particular bat that brought me to Simla in

1960 accompanied by a physicist colleague, Dr. J. J. G. McCue of the Lincoln Laboratory of M.I.T., was one to which Charles Kingsley first called attention after a trip from England to Trinidad in 1869. Resting one evening on the shore of Monos Island close to Trinidad he observed:

"As it grew dark, dark things came trooping over the sea, by twos and threes, then twenty at a time, all past us toward a cave near by. Birds we fancied them at first, of the colour and size of starlings; but they proved to be bats, and bats, too, which have the reputation of catching fish. So goes the tale, believed by some who see them continually, and have a keen eye for nature; and who say that the bat sweeps the fish up off the top of the water with the scoop-like membrane of his hind-legs and tail. For this last fact I will not vouch. But I am assured that fish scales were found, after I left the island, in the

Noctilio, the fishing bat, had dipped down to the surface of the experimental pool; its whole hind foot is below the surface, reaching for any edible bit of fish the experimenters may have hidden there.

Photo by the author

stomachs of these bats; and that of the fact of their picking up small fish there can be no doubt." (from "At Last, a Christmas in the West Indies" 1871).

The bats were *Noctilio leporinus*, the best known of three or four species of bats that vary a diet of insects with small fish. They have a wingspread of about two feet, greatly enlarged hind feet for their size, and their short fur is either a distinguished gray or a deep brownish-red, depending upon which of two color phases one has in hand.

It was not until long after Kingsley's travels that we learned about the ultrasonic orientation sounds of bats, the brief chirps at frequencies above the range of human hearing by which bats guide their flight. All bats in the Western Hemisphere use this natural sonar as their principal means of avoiding collisions with obstacles, and many also catch insects by echo. Having analyzed the precision with which New England bats locate and intercept small insects such as mosquitoes or fruitflies, relying entirely on their sonar for split second interception maneuvers,

it was only natural to inquire how a fish-catching bat would go about locating fish. How, for instance, did such a bat decide whether a particular object in the water was a floating leaf, a soggy twig, an empty bubble, or a juicy minnow? I had once watched the fishing of *Noctilio* from a dugout canoe on the Chagras River in Panama, but we needed a concentrated combination of field and laboratory studies in which the bats could be induced to do their fishing under controlled conditions favorable for observations and experiments, within convenient range of microphone and camera.

Amplifiers, tape recorders, oscilloscopes, all slenderized by recent advances in electronics, permit precise and searching measurements with less than the truckload of apparatus needed just a few years earlier. But a large flight cage was equally essential, in which a fish pool could be included. The Office of Naval Research has generously supported our research on bat sonar for several years, and I am most grateful that their interest was sufficient to make possible an intensive study of the fishing bats. At Simla this venture was enthusiastically welcomed and greatly facilitated by the background of local experience with all the varied problems of tropical zoology. A new enterprise of this sort is always a gamble, since one can never be quite sure until the structure is completed and put to use whether the animals for which it was designed will find it compatible with normal behavior. In this case we could build on Prentice Bloedel's discovery that *Noctilio* would catch fish in captivity from a shallow pan located on the floor of a screened porch only three times as wide as the bat's wingspread. With the devoted help of the staff at Simla, two Harvard students, Alan D. Grinnell and Clarke Slater, constructed an outdoor flight cage 12 × 48 feet in size, containing a fish pool 6 × 20 feet in surface area. Both the bats and our apparatus have functioned at their best for a reasonably large fraction of the time when experiments were in progress. The former could swoop and turn without serious inhibitions, the latter could be nourished with A.C. power.

There were minor problems during the rainy season (which occupies the customary academic summer recess), such as the sudden showers which caught us with many delicate gadgets un-

covered for action but also for inundation. Power lines in rural Trinidad were not quite equal to supplying the needs of the latest multiple electronic flash lamps fresh from Professor Edgerton's laboratory at M.I.T. Since almost every electronic circuit is highly vulnerable to humidity, fungus, corrosion, and other inconveniences of the rainy season, a dark room was set aside as a dry chamber in which the apparatus could spend most of its time in the temperate microclimate where it had its genealogical roots. Only for a few hours at a time was it necessary to carry apparatus out for action with the bats and the mud. One disaster was narrowly averted by correcting a clerical oversight in the nick of time just before everything was packed for shipment to Trinidad. Instead of a *dehumidifier* to desiccate our little sanctuary, the appliance dealer had all but shipped to Trinidad a *Humidifier* built to spray water into the air for the pampering of delicate human throats and noses.

A special reason for wishing to concentrate our attention on the fishing behavior of *Noctilio* was the physical difficulty of detecting echoes from a fish at or below the water's surface. Field observations in Panama had suggested that these bats made attempts to catch their fish both on calm nights, when they dipped their specialized hind feet into the glassy water of a fresh water pond or the backwater of some muddy river, or with equal zest they might fish over the ocean where a light breeze rippled the surface. Sometimes the fish were caught as they jumped clear of the water to escape some bigger fish from within their own medium. But often no disturbance of the surface could be seen from the shore as we would watch the *Noctilio* skimming over the surface of perfectly smooth water. Then from time to time, but often hundreds of yards apart, the bat would dip lightly against the surface, presumably in the realistic hope of catching a minnow-sized fish. *Noctilio* also catch many insects so that they presumably retain most of the behavioral traits of their insectivorous ancestors. Echoes from ripples, leaves or twigs floating on the surface must complicate the sonar operations of a fishing bat.

So many other kinds of bats have been shown to rely almost totally on their sonar not only for general orientation, but also for insect catching,

that the presumption was strong that *Noctilio* would turn out to be equally dependent on acoustic echoes rather than starlight. This was soon confirmed by setting out small, dead minnows or pieces of larger fish, held on fine wires just at the surface of our experimental fish pool. In daylight or on the darkest nights, hungry bats would snatch their morsels of food from the water surface within a few seconds after they were set out. Not that these or any other bats are always perfect connoisseurs of echoes. Often they seem clumsy, make mistakes, become disinterested, or persist in chasing insects instead of attacking our choice minnows fresh from the local streams. But when strongly motivated by hunger, or perhaps by boredom from a long day in the roost box, the more enthusiastic and expert of the bats could be relied on to swoop down avidly at our experimental targets.

It was now possible to watch and photograph the dexterous fish-snatching in which these bats make use of their specialized hind feet. Each toe is long and flattened from side to side, as though squeezed in a truly vise-like handclasp. This flattening extends to the claws, and the fingers plus claws are almost as long as the animal's head. All ten toes are so oriented on the leg that when lowered into the water they form a pair of diminutive but sharply hooked gaffs. A fishing *Noctilio* flies with the body about three inches above the surface, the wings executing short, shallow strokes so that their tips barely clear the water. The hind toes and claws are usually within a quarter-inch of the surface, and often they are extended straight back as shown in the drawing, so that the fish gaffs can be brought into action within a small fraction of a second by a rapid contraction of the muscles that flex the toes. Like most bats, *Noctilio* has a part of its flight membrane extending between the two hind legs, and firmly attached to the tail. This tail membrane seems to serve as part of the bat's control system, perhaps also as an equivalent to an airplane's wing flaps. It can be seen to be lowered while the bat is fishing, and before Bloedel's photographs demonstrated otherwise, many zoologists agreed with Kingsley's friends "with a keen eye for nature" that fish were scooped up with this apron-like sheet of skin. Since a small splash left no doubt that many of the fish were taken from just below the



Above — Dr. Griffin and two of his assistants watch a fishing bat at the Trinidad pool, its tail membrane lowered after an unsuccessful pass at one of several pieces of fish on wires just above the surface. Right — Assistant Suthers holds a transistorized bat detector, listening to orientation sounds.

Both photos by Ian Chan

surface, aerodynamic considerations of the most elementary sort cast severe doubts on the efficacy, or indeed even the possibility, of such fish-scooping. Were a bat to try dipping the tail membrane into the water, he would probably suffer the same fate as a pilot who dragged a sea anchor behind his plane as it skimmed just above the waves.

Instead of such apron-dipping, *Noctilio* raises the tail and the attached membrane within a half-second before contact, so that only the hind feet are dragged through the water. It is the specialized toes and hook-like claws that actually make contact with a live fish in nature, or with one of our substitute targets held near the surface by a small vertical wire rising from the bottom of our experimental fish pool. Once a fish has been gaffed, the successful foot or feet are swung forward towards the mouth, as the bat flies on. With the aid of one or both feet the fish is transferred to the well-armed mouth and chomped to bits by the work of relatively powerful jaw muscles. These bats have large pendulous lips, and partly chewed fish are often held in the resulting chipmunk-like pouches for several min-



utes while being gradually reduced to esophagus-sized fragments. This chewing may occur audibly as the bat flies back and forth, or more often it lands in the conventional head-down posture of bats from the wall or roof of the cage. Juggling a slippery, uncooperative minnow is no easy task, and many were dropped uneaten, even by the most expert of the bats we have studied. Whether similar losses occur in nature remains for future studies to determine, along with many other details of the fish-catching techniques, which may well vary from one situation to another.

One of our chief interests concerned the detection of fish to be captured. Was it true, as

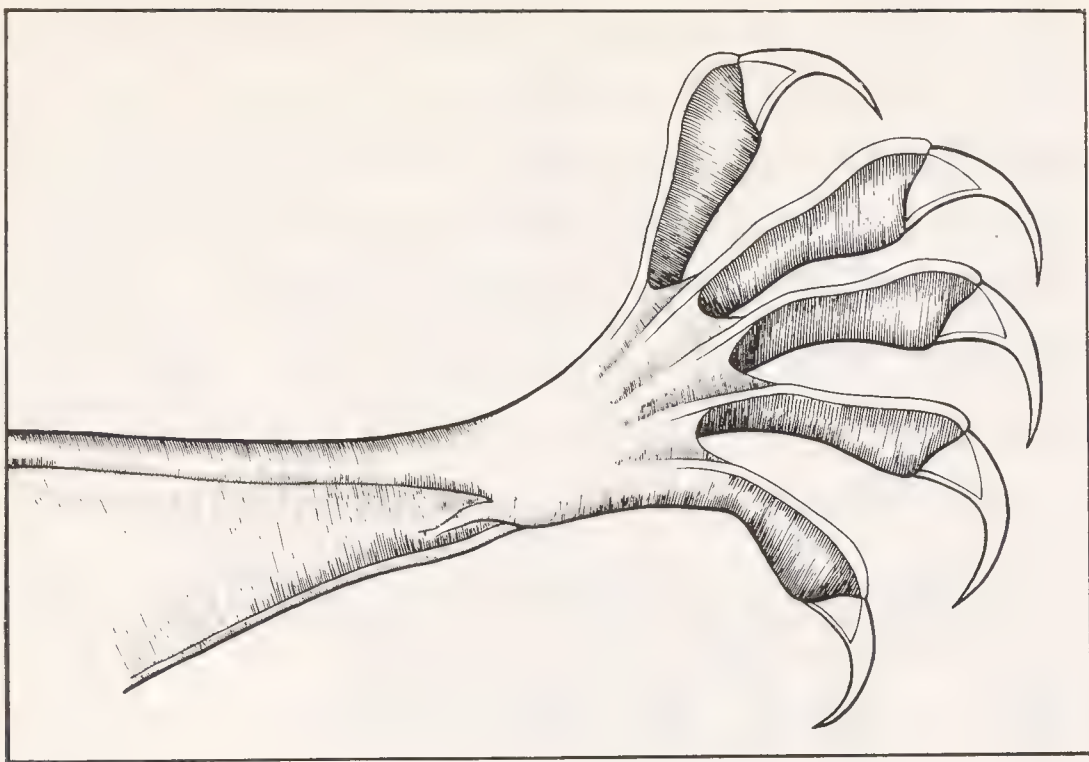
preliminary observations had suggested, that fish were sometimes detected and caught while wholly submerged? Or could the bats locate only fish that disturbed the surface? In acclimating *Noctilio* to life in the bat cage at Simla, we first fed them on dead minnows or small pieces of muscle from larger fish held on wires just above the surface. After the bats had learned to obtain all their food in this way the wires were progressively lowered so that less and less of the food projected above the surface. As long as a sixteenth of an inch or so was in the air the bats had no difficulty locating and snatching it. But when the last millimeter of the target morsel was submerged the bats began to have real difficulty in accurately locating their food. Some never could, but a few very expert fish-snatchers did manage to keep themselves well nourished by diligent efforts to find and grasp the wholly submerged food.

We were not surprised that the bats found submerged targets much more difficult to locate than those projecting even minutely into the air. The transmission of sound waves from one medium to another (from air to water, for example) is much more difficult, physically, than the simple movement of sound waves through either medium alone. If the *Noctilio* were in fact detecting submerged fish, it would most likely be by echo, or at least not by vision, because darkness and impairment of vision had no effect whatsoever on the bats' success with either projecting or submerged targets. If an echo is to be produced by a submerged fish, the sound waves from the bat must first enter the water, then strike the fish, be transmitted back through the water surface into the air, and finally be heard by the listening bat in time to elicit the grasping action of the hind feet. Even under favorable conditions only about one thousandth of the sound energy striking the water surface enters and continues as underwater sound; worse still, an echo from a fish suffers the same energy loss on re-emerging from water into air. Thus the two trips through the air-water surface reduce the strength of a possible fish echo to little more than one millionth of the echo that would return from an object with similar echoing properties separated from the bat by nothing more than air. But might the bats not overcome this severe

handicap? Their orientation sounds were at least a billion times louder than the minimum echo that other bats can hear, and surely the catching of fish must have an overriding importance to *Noctilio* under natural conditions. If it was not echoes from submerged fish, what *did* enable the wild *Noctilio* to dip their feet here and there, below the glossy, and apparently undisturbed, water surface, presumably with some realistic hope of catching dinner?

Torn between these conflicting considerations I tested one particularly active and energetic *Noctilio* with submerged food targets every night for a month. When hungry he would often swoop down from the end of the cage and seize the submerged morsel immediately without any apparent difficulty. At other times he would drag his hind claws through the pool for twenty, thirty, or even more flights without touching the submerged target at all. In order to control target location and position relative to the surface, a moveable, underwater target holder was set up across the middle of the pool. The actual position of the submerged fish was varied over a distance equal to about eight times the "toe-spread" of the fishing bat, that is the distance between the outermost claws of the two hind feet. Thus in this situation the bat had about one chance in eight of catching a fish even though his efforts were wholly random. In some series of experiments the most adept bats required on the average only a little more than four flights across the target zone before coming into contact with their staked-out quarry. This can be interpreted as better than chance success, but obviously not much better! In nature *Noctilio* can scarcely ever have a second chance at a particular fish that he may locate at rest just below the surface.

One achievement of the *Noctilio* has become abundantly clear. This is an impressive ability to locate and snatch at any small projection above the surface that has been associated with food. When one bat had just snatched a fish from a wire extending only a quarter-inch into the air, another often swooped past two or three seconds later and struck hard at the same short piece of projecting wire. Certain of our *Noctilio* have learned to snatch pieces of fish from just below the surface when their location was marked by a short length of fine wire projecting up through

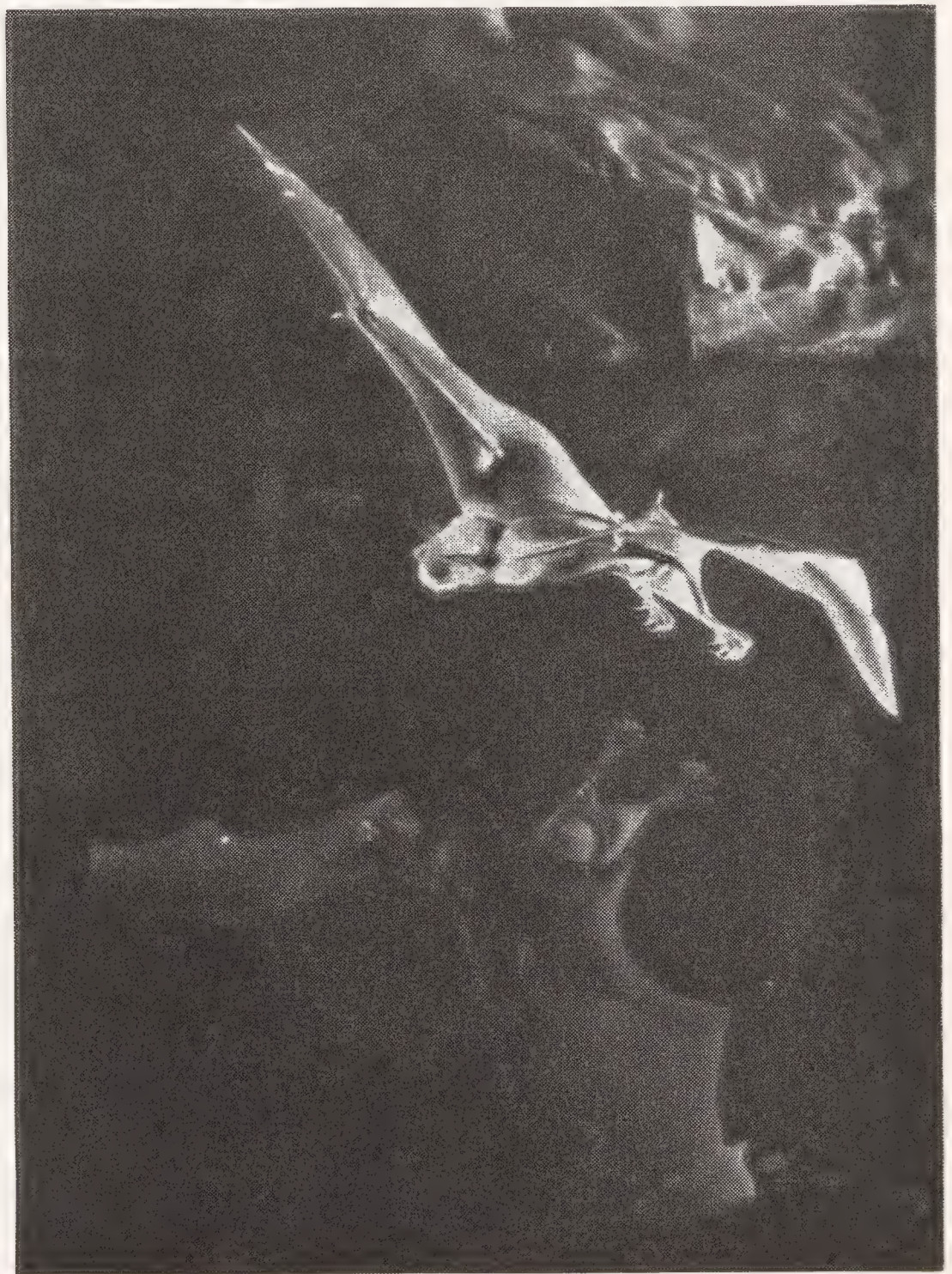


Left — Hind foot of *Noctilio*, showing flattened toes that slice the water with minimum drag. Below — Fish ahead, and a *Noctilio* has its hind claws in position for a split-second grasping.

Drawing by Julie C. Emsley, photo by the author

the surface into the air. As little as a quarter inch of wire the diameter of a common pin is quickly and accurately located when a hungry *Noctilio* has learned that it marks the location of a piece of fish.

In such experiments precautions must be taken to see that the bat does not simply learn the location of the pin and fish. Consequently the location of the target morsel was shifted between presentations, but wherever in our pool it was located the bat would discover it just as easily in the dark as when our flashlights were turned on. Even though we had long ago become convinced that almost all bat orientation is based on echoes, whenever some new aspect of their orientation is under study we must check to be sure that this, too, is possible in darkness. Lacking a light-tight darkroom large enough to contain the fishpond, we relied on the almost total obscurity of the shaded bat cage on moonless nights, with heavy clouds and closely impending rain. With all lights extinguished we would release a hungry bat, hear its wingbeats and a small splash as it dipped into the water, and suspect that it had snatched its fish from one of our wire holders. But sometimes the bats would dip at insects floating on the pool, or simply try their luck elsewhere than at the target-making wire. To ascertain on which flight the target was actually struck, we sometimes tied a thread to the wire support, stretched the thread underwater to the edge of the pool, and held it, also underwater, to feel the jerk as the fish was snatched. When the target was located at random on any one of 81 different spots (selected by tossing dice beside the pool) the bat would almost always seize it within the first four or five flights even on the murkiest rainy nights.



We have tape recordings that display in detail the orientation sounds and how they change during the stages of search for the fish, detection of a promising target, and closing in for the actual grasping snatch. At this writing the analysis of these recordings, and accompanying motion pictures is far from complete. Yet it is obvious that small objects projecting above the water surface are quickly and accurately located by echo, and that the subsequent seizure of a soft and slippery fish requires a speed and dexterity that is difficult to match. For example, within much less than a tenth of a second following the first contact of its hind claws with one of our experimental targets, a *Noctilio* must feel whether it is a soft and yielding piece of fish, a floating but nearly waterlogged twig, or perhaps merely a piece of the wire fish holder. Before the sharply-curved gaffs are hopelessly entangled in the wires these must be rejected, and a fish must be clutched tightly in the split second before the bat has flown on past. To succeed, as in fact the

bats so often do, this type of fishing must call for an impressive blend of footwork and dexterity. Whether *Noctilio*'s repertoire of fishing skills also includes the supremely difficult operation of recognizing echoes from fully submerged fish, we cannot say with final assurance. At the very least this is much more difficult than detecting even the smallest of naturally occurring targets

that fall on the water's surface. It may well be that under natural conditions submerged fish are detected only when they disturb the surface. Further studies of *Noctilio* are now underway by two Harvard students, Roderick Suthers and Ann Graybiel, and in due course we can hope for a more complete understanding of the fishing lore of these specialized bats.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

Hummingbird Migration Produces Our Annual Ruby-throat

One of nature's signposts on the road to winter is the annual migration of birds. The Ruby-throated Hummingbird is one of the earliest migrants — and one to whom accidents frequently happen. Our records for the past thirty years show that with the exception of 1937, 1940 and 1961, we have received at least one hummingbird each season during their southward journey. This season's bird was brought in on August 28 (the record shows only one earlier, on August 15, 1955). It was a young male that was picked up, exhausted, on a mid-town Manhattan street, and after feeding on our regular hummingbird formula it is now doing well in the Jewel Room.

Aquarium Laboratory Finds New Biochemical Substance

An entirely new biochemical substance from the brain of fishes has been found by the Laboratory of Marine Biochemistry and Ecology at the New York Aquarium. It has been partially characterized as neurosine, an oligopeptide. Enough of the substance, which is present in relatively large amounts in the brain, has been extracted from moss bunkers and partially purified to permit its testing for activity on the nervous system.

The summer's work at the laboratory also discovered a new source of a biologically and pharmacologically active substance — water- and alcohol-soluble active materials that are present in the invertebrates generally known as "moss animals" (bryozoans). These have been found

abundantly on both the north and south shores of Long Island, and initial studies indicate that the crude substance interferes with the normal development of sea urchin eggs, producing a condition called animalization. The work is being supported by a grant to the Society by the John A. Hartford Foundation, Inc.

IN BRIEF

Dr. Osborn in Africa. President Fairfield Osborn attended the meetings of the International Union for the Conservation of Nature and Natural Resources in Nairobi in September. During approximately the same period Director William G. Conway of the Zoological Park attended the meeting of the International Union of Directors of Zoological Gardens in Chester, England, and visited sixteen European zoological gardens.

Monkey Mystery. When a Capuchin Monkey escaped from the Children's Zoo late in the summer, an immediate hunt was organized and there was little difficulty in recapturing the animal in the southeast corner of the Zoological Park. In the course of the search the keepers' posse gathered up two more monkeys — both of them Squirrel Monkeys, a small species often kept as pets. One was reclaimed by a resident of the neighborhood but the origin of the second one is still a mystery.

Trespassers, Keep Out. Just over a mile of barbed wire has been strung on top of the border fence on the west and south sides of the Zoological Park to discourage after-hours visitors.

Medal to Dr. Osborn. The Louis Bromfield gold medal for "Outstanding contribution to soil and water conservation through the use of the medias of communications" has been awarded to President Fairfield Osborn. He gave the fourth Bromfield lecture, on "Food, Fiber and Shelter for the Human Race."

New Range for Wisents. Late this fall a new animal exhibit will be opened in the woods east of the present Roosevelt Elk range. Behind a 135-ft. moat, and surrounded by fence, our trio of Wisents, or European Bison, will have a new home more nearly like their native forest habitat.

African Students as Keepers. Two of the Zoological Park's temporary assistant mammal keepers this past summer are African students. Boniface Odero, usually assigned to the African Plains, is from Kenya and plans to become a physician. Cyrus During, from Nigeria, has been working in the Small Mammal House and intends to go into teaching in his homeland.

Bird Walk. An elevated passage through the Large Flying Cage will be opened this fall. Constructed in our own shops, it will permit visitors to walk diagonally across the large aviary and to be among the birds, more nearly at their own treetop level. The bridge is 70 feet long and two 25-ft. ramps give access to it from the east and west sides of the aviary.

Lion Cubs Out. Two Lion cubs — a male and a female — were born at the African Plains on August 1 and made their first appearance outside the shelter house in mid-September. Their mother, who led them out, was nervous and seemed continually worried when they wandered too close to the edge of the moat around Lion Island. They should be making daily appearances a little later in the fall.

Bushmasters Again. Two Bushmasters have been given to us, one from an individual in Trinidad and the other from the Emperor Valley Zoological Park in Port-of-Spain. They have been placed in an air-conditioned exhibition section in the hope that at least one of them will accept food and survive. Night-time cooling, such as occurs in the tropical forest after sundown, apparently is essential if Bushmasters are to be induced to eat in captivity.

PUBLICATIONS OF INTEREST

FINDING OUT ABOUT MAMMALS. By Joseph A. Davis, Jr. 56 pp. text, 8 pp. color photographs, many drawings by Lloyd Sanford. Home Library Press, New York, 1963. \$2.95.

WONDERS OF THE LIVING SEA. By Carleton Ray. 56 pp. text, 8 pp. color photographs, many drawings by Oscar Liebman. Home Library Press, New York, 1963. \$2.95.

Two very readable books for children of the 11 to 16 age group, the first by the Zoological Park's Curator of Mammals and the second by the New York Aquarium's Associate Curator. In the same series, and at the same price, are "Finding Out About Birds," by William C. Dilger; "The Insect World," by John Pallister; "The Story of Our Earth," by Arthur N. Strahler; and "The Wonderful World of Plants and Flowers," by Howard W. Swift.

MAMMALS AND HOW THEY LIVE. By Robert M. McClung. Illus. by 38 photographs in black-and-white. 83 pp. Random House, N. Y., 1963. \$1.95.

This attractive little book is a useful addition to the Life Science group of the Easy-to-Read Science Library. Briefly and simply it provides an easily assimilated introduction to the great group of mammals. A surprisingly broad range of subjects is covered, including the origin and definition of mammals, how they live, find their food, how they accommodate to the seasons and how their young develop. At the end there is a simple arrangement of mammalian Orders, as well as an index. The illustrations have been carefully chosen to support the text and are very good indeed. This latest work of Mr. McClung will be welcomed eagerly by children of all ages. — L. S. C.

EXOTIC BIRDS: PARROTS, BIRDS OF PARADISE, TOUCANS. 16 color plates by Jacques Barraband and Auguste; text after Francois Levaillant, translated by Eric Mosbacher. A Studio Book: Viking Press, New York, 1963. \$12.50.

Admirers of large color plates of birds, and who cannot afford Levaillant's original volumes published between 1796 and 1812, will be attracted by these selections exquisitely printed in Germany. Page size is 11 $\frac{5}{8}$ by 15 $\frac{3}{4}$ inches.

SNAKES. By H. W. Parker. 191 pp., 23 photographs, 11 text figs. W. W. Norton & Co., Inc., New York, 1963. \$5.95.

This recent book on snakes, written by a leading authority (the recently-retired Curator of Reptiles of the British Museum), should be a good one — and so it is in concept. After a chapter on "origins and evolution" there are six on what snakes do — on food and feeding, defense, reproduction, etc. These are followed by three chapters on snake classification and relationships and a final chapter on snakes and man. However, I am afraid that the poor illustrations, the sixty-word sentences, and the page-long paragraphs will discourage any but the most devoted from obtaining the valuable information that it contains. — H. G. D.

FRESHWATER FISHES OF THE WORLD. By Gunther Sterba. 878 pp., 102 color plates, 1091 photographs and line drawings. The Viking Press, New York, 1963. \$17.50.

In spite of its somewhat inclusive title, this book treats only of those fresh water fishes of the world which have been kept more or less successfully in domestic aquaria. It includes about thirteen hundred species, with a few fishes in the same general category omitted. However, these omissions will not readily be missed by most fanciers. It is by far and away the best tropical fish book at present in print. — C. W. C.

Natural History Press Books

A welcome series of books, both new and reprints, is beginning to flow from the Natural History Press which, as a division of Doubleday & Co., is publisher for the American Museum of Natural History. We have space to do little more than mention the titles as they appear; the auspices under which they are published is assurance of their value.

WASP FARM. By Howard Ensign Evans. 178 pp., photographs and drawings. Natural History Press, Garden City, N. Y. \$3.95. An absorbing account of living with and studying wasps on an 8-acre farm in upstate New York. Dr. Evans is Associate Curator of Insects at Harvard's Museum of Comparative Zoology. A hardcover book.

BIOLOGY OF BIRDS. By Wesley E. Lanyon. 186 pp., drawings. American Museum Science Books. Paperback, \$1.25. The subtitle is: "A concise introduction to the life of birds" and it is exactly that. Dr. Lanyon is on the staff of the Museum. A hardcover edition will come later.

EXPLORATION OF THE MOON. By Franklyn M. Branley. 146 pp., photographs and drawings. American Museum Science Books. Paperback, 95 cents. An up-to-the-minute book that gives background for the "moon shots" coming in the next few years. Dr. Branley is on the staff of the American Museum-Hayden Planetarium. To be published in hard cover later.

INDIANS OF THE PLAINS. By Robert H. Lowie. 258 pp., photographs and drawings. American Museum Science Books. Paperback, \$1.95. Originally published in the Anthropological Handbook Series by the Museum.

INDIANS OF THE NORTHWEST COAST. By Philip Drucker. 224 pp., photographs and drawings. American Museum Science Books. Paperback, \$1.95. Originally published in the Anthropological Handbook Series by the Museum.

PEOPLE OF THE FOREST. By Hans Lidman. 191 pp., 143 photographs. The Macmillan Co., New York, 1963. \$7.50.

Nature photography in Scandinavian forests, most of

it of a very high order. The text sets the scene for the pictures.

THE MAMMALS. Life Nature Library. 192 pp., many illustrations, photographs and drawings, in color and black-and-white. Text by Richard Carrington. Time, Inc., New York, 1963. \$3.95.

With the dramatic presentation one would expect from the editors of *Life*, "The Mammals" covers most of the popular approaches to the mammals of the world — their variety, evolution, locomotion, food, defences, migrations, reproduction, relations with man, and so on. The text is substantial, the drawings and paintings explicit and the photographs, for the most part, action-filled and extremely effective.

A STUDY OF BIRD SONG. By Edward A. Armstrong. 335 pp., many photographs and drawings. Oxford University Press, London, 1963. 45 shillings.

Mr. Armstrong's approach to bird song "as one aspect of a delicately integrated complex of behavior" was briefly expressed in "Songs for All Occasions" in the January-February *Animal Kingdom*. This book is described as "the first extensive review of bird vocalization" and should interest the amateur as well as the professional ornithologist.

PRIMATE SOCIAL BEHAVIOR. By various authors, edited by Charles H. Southwick. 191 pp., illus. D. Van Nostrand Co., Princeton, N. J., 1963. Paperback: \$1.95.

Essays and popular articles, some of them reprinted from various journals and others newly written, on aspects of primate social behavior. "In the Home of the Mountain Gorilla," by Emlen & Schaller, is reprinted from *Animal Kingdom*.

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It's Good Zoo-going Weather...

There are four seasons of the year when a visit to the Bronx Zoo is particularly enjoyable. You can probably guess what they are.

However, since Spring and Summer are already past, and Winter is still to come, that leaves us with the warm, mellow, russet-hued days of Autumn. There's still a lingering echo of the summer excitements—but fewer people. We sometimes think the animals are *glad* to see visitors on these quieter days when the summer has faded.

It's an open invitation. And our Members are especially welcome.



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ANIMAL KINGDOM



THE MAGAZINE OF THE NEW YORK ZOOLOGICAL SOCIETY

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ANIMAL KINGDOM

Bulletin of the
New York
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Refuge for Threatened Animals

The recent public announcement that a Wildlife Survival Center is to be established in the Zoological Park has attracted a considerable amount of favorable comment. To cite one development, the United States Information Service has asked for the right to use excerpts of our recent statements as they appeared in the *Sunday Times Magazine* in their international news service.

The Center is a novel idea and holds good promise of success. It will enable the development of research programs that may be important in the management of both wild and captive animals. It will act as a buffer against extinction for critically endangered forms and, hopefully, will be a source of animals which would be available for transplanting back to their original habitats where they no longer exist. Lastly, and of large importance, it will call public attention to the plight of vanishing species and acquaint people with the kinds of animals that are seriously endangered.

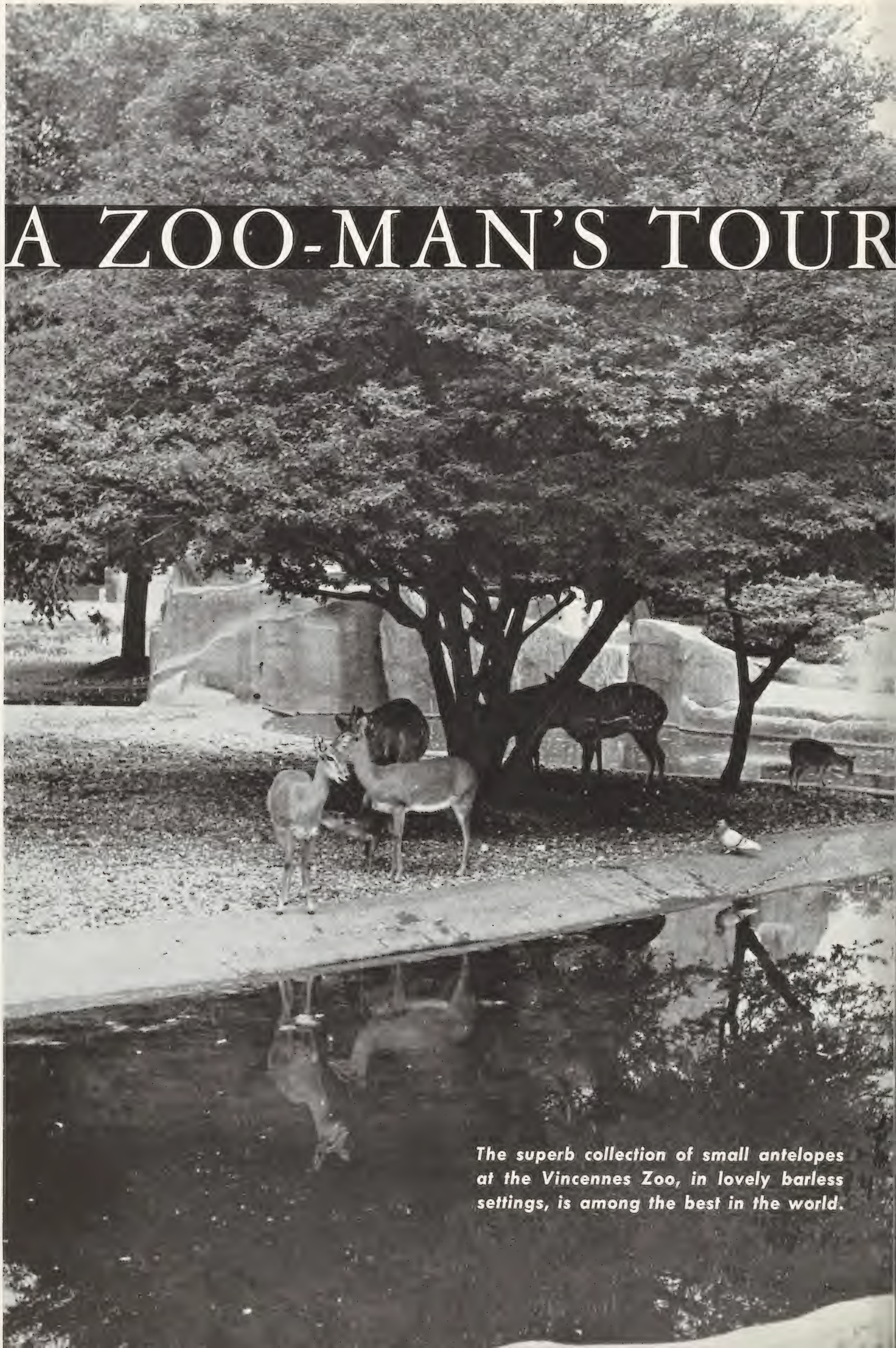
Past experience has shown that many species of wild animals can be successfully bred and reared in a zoo. In our own case, the Zoological Park successfully bred, a number of years ago, Arabian Oryx, now on the verge of extinction, and is presently breeding Père David Deer, now extinct in its own habitat in China, and, as still another example, the Okapi, whose status in the Congo is doubtful.

Obviously any program of this kind has its limitations. No single step such as this can do more than serve as a contributing factor to relieve the wildlife crisis as a whole. The major effort in wildlife preservation must be aimed at the protection of wild animals in their natural habitats. Yet there are corollary actions, such as the new Wildlife Survival Center, that zoos in our country as well as those abroad can take. Already the American Association of Zoological Parks and Aquariums has unanimously passed resolutions that its members will refuse to acquire certain species which might be endangered by collecting — the Orang-utan, for example. As part of this coordinated movement we may hope that the Survival Center idea will be adopted by other zoological parks. It is a time of emergency when concerted action is imperative.

Fairfield Osborn

SMITHSONIAN
INSTITUTION

DEC 26 1963



A ZOO-MAN'S TOUR

The superb collection of small antelopes at the Vincennes Zoo, in lovely barless settings, is among the best in the world.

OF EUROPE

By WILLIAM G. CONWAY

Director, Zoological Park

TO KEEP ABREAST of new developments in this field is the first obligation of every specialist, no matter whether he is a doctor, a physicist, or a member of that small group called zoo directors. Most zoos send out magazines and guidebooks announcing new exhibits and, like many other professional groups, zoo men have local and international organizations which meet from time to time to exchange information and debate the merits of new ideas. But there is no substitute for actually seeing other zoos, personally judging the effectiveness of their techniques, and considering their application to one's own institution. Thus, when it was announced that the annual meetings of the International Union of Directors of Zoological Gardens would take place in Chester, England, I made arrangements to visit as many zoos on my way to the meetings as three weeks would allow.

Of course, the meetings themselves were important, for they drew scientific papers and zoo directors from all over the globe. Pretoria and Paris, even Czechoslovakia and Poland, Berlin and San Antonio, were all represented. But an unhappy "sign of the times" was evident in the great amount of the program devoted to discussion of the plight of vanishing animals and of zoo attempts to render aid. Of course, we also noted proper formulas for baby Clouded Leopards, discussed the love-making of Orang-utans, and reviewed evidence for an allergy in giraffes to onions. Yet for me, the greatest number of ideas from the trip came from the three weeks spent visiting seventeen European zoos in five countries. New ideas in each of seventeen zoos? Yes, new ideas in Amsterdam and in Zurich, in Berlin, Frankfurt, Vincennes, Paris and Munich, in

Wassenaar, Munster, Whipsnade, and Clères, in Hamburg, Rotterdam, Basle, Hannover, London and Chester — for every single zoo presents new facets of the search for solutions to that complex problem: the exhibition of wild animals to human beings.

Some of these zoos are very old and some are fairly new — some great, some small, but all very different. And an examination of these differences was the principal purpose of my trip, for the knowledge of techniques, unsuccessful as well as successful, is essential in our own zoo's development plans. I especially wanted to see how certain exhibits *looked*. Their visual aspects, the esthetic solutions used by zoos attempting to confine animals without seeming to do so, the attempts to satisfy the animals' behavioral requirements within the exhibit, and, importantly, an evaluation of the comparative success of these efforts, might furnish more answers to the two basic technical questions of zoo display. How can we give the zoo visitor a better idea of the animals in the wild? And yet, paradoxically, how can we reveal for him the intimate, even strange, detail which comprises each creature's life close-up?

Well, close-ups, sideviews, and landscape photographs of almost every new major zoo exhibit, supplemented by pages of notes, were my answer to at least one problem, how to bring back and share these exhibition details with my Bronx Zoo associates. A bulging notebook and more than 500 photographs bear testimony to the imagination and kindness of European colleagues who submitted, with enthusiasm, to lengthy, probing questions. One moment our queries might dwell upon the comparative virtues of sand, peat moss,

or teak wood as a carnivore cage floor, and the next upon relative humidity in fruit-bat exhibits, and sooner or later they came to the minimum safe barrier for the maximum exhibition. Finally, to be sure, the exhibits spoke for themselves.

Certainly, photographs are the best transportable voice for zoo exhibits. Unfortunately, the rain and cloudy weather which followed me from Holland to Great Britain did little to aid photography; besides I often concentrated on the less photogenic technical aspects of the displays. The structure of a concealed moat or the placement of an electric wire was often the technical key to an exhibit's success and important details were scattered, for zoos are difficult to reduce to types.

It doesn't seem to me that there is any characteristic that typifies zoos by nations except for the language used on the labels. Amsterdam's zoo is more like Berlin's than it is like Rotterdam's, and Rotterdam's resembles Whipsnade more than Whipsnade resembles its parent zoo, London! Of course, the newer zoos differ in exhibition methods from the older zoos, but then the older zoos are renovating so rapidly that they are often ahead of the younger zoos. In fact, the more I try to write about the "kinds" of zoos, the more hopeless their classification seems. It is a good thing that zoos have animals as well as exhibits and techniques — otherwise they wouldn't have anything in common!

But every zoo had wonderful animals, often beautifully displayed in breeding groups. And, every now and again, as I mentally thumb through the events of my zoo odyssey, I remember some wonderful family of exquisite wild creatures I had never dared hope to see. Images of these creatures and of zoo exhibition techniques are fixed in my memory but not by zoo size or zoo age, just simply zoo by zoo.

Amsterdam seems like a good place to start, for I started my zoo expedition there on a raining Friday morning at 7 a.m. Our old friend, Director Ernst Jacobi, materialized at the airport like a benevolent (and multilingual) wraith out of the Netherlands drizzle. The zooing was under way and perhaps my notes, largely technical, are best reduced to some of those supplemental details which I couldn't resist putting down, though they are not the sort of data that will help us

build a nocturnal house, a South American display, or new bear exhibits. Amsterdam's Zoo, *Natura Artis Magistra*, as it is called, is not so great in area as it is in age for it covers but 25 acres and was opened in 1837. If *Artis* is an example, then the area of a zoo has little to do with the size of its collection, for the collection is large and includes an attractive aquarium opened in 1882. Somehow, it is possible to walk and walk on shady paths past exhibit after exhibit without catching sight of the zoo's borders. One attractive sign especially caught my attention. It said, "wereld der duisternis" and Dr. Jacobi reminded me that he had written us last year for permission to use the title of our forthcoming building, the "World of Darkness," for his own nocturnal exhibit, then under construction. The new display has been a great success in Amsterdam and exhibits a truly superb collection of night-loving rarities. Imagine seeing that curious aboreal marsupial, the Cuscus, within a few feet of a slow-moving Asiatic Slender Loris and its distant cousin, the fox-faced African Angwantibo. An eerier trio defies imagination. And, leaving the "duisternis," imagination is also needed to picture hippos breeding successfully in Amsterdam's old (and soon to be replaced) hippo house. Yet here, in a building converted from an old mill in the 1880s, was the latest of 28 baby hippos growing happily, a testimony to expert animal keeping.

Like every major zoo I have visited in Europe, *Artis* charges admission (two guilders), and like most European zoos it bars the feeding of animals by visitors. Such feeding by the public, because of its attendant health hazard for the animals, is the bane of zoo directors the world over. And the various signs erected in zoos forbidding feeding are an interesting international comment on the problem.

In Amsterdam we noted a series of special signs around the zoo. One translates:

"A real friend to the animal
looks at it —
and *doesn't* feed it."

In Wassenaar, near the Hague, a large skull and crossbones sign calls attention to the oft-repeated warning: "Verboden te voederen." To enter the Zurich Zoo, one must pass the prominent notice: "Only the keepers may feed." But the Frankfurt system is by far the most formid-

AMSTERDAM



Amsterdam Zoo Director Jacobi remarked with resignation as Mr. Conway photographed his Polar Bear display: "Every Zoo Director who comes to Artis says 'How old-fashioned — I must take a picture!' " But it is charming, too, in a very European way.

"World of Darkness," proclaims Dr. Jacobi's attractive sign at the entrance to an exciting new exhibit of various nocturnal animals.



Penguins, Gannets and Baikal Seals comprise the exhibit in this striking new display in Amsterdam Zoo.



ROTTERDAM



able, for here a sign says, in translation, "Feeding: 25 Deutschmarks and expulsion from the Gardens."

The feeding problem is common to every zoo, but very often it is the zoo with a special problem which makes a significant advance in exhibition techniques. One of these "special problems" is soft, unstable ground and Blijdorp, the zoo in Rotterdam, has met this difficulty in an interesting way. My notebook characterizes Blijdorp as: "Opened 1940, area 29 acres, organized about central viewing tower, with several very large, very flat, very beautiful group exhibit enclosures (bison, deer, cranes, banteng, zebra, nilghai, etc.), greenhouse theme, especially in Birdhouse." Like other modern zoos, Blijdorp wanted to use moated rather than fenced or barred enclosures, but a high water table and very soft ground made the construction of moats, as well as their cost, such a serious problem that another answer had

Rotterdam's amazingly low leaning fences have been developed to meet the problem of unstable ground — and they work! We are adapting this type of fence to a new enclosure for our own Wisents.

to be found. The answer was the development of a low, inward-leaning fence near the top edge of a very shallow ditch. The fence is so low (and inexpensive) that it is difficult to see why it works. Certainly the deer and antelope in Rotterdam, if not the bison, should be able to jump out — but they don't. The Frankfurt Zoo is copying the fence-moat in an antelope display and we are cribbing it for a new Wisent range — so Dr. Grzimek and I do hope it works!

There is more than meets the eye to this curious fence and we suspect its leaning angle may have psychological effects difficult to assess. We know that animals which will not try to clear a six-foot fence will readily jump a six-foot solid

moat wall, and a bit of fence with a bit of moat may be just the needed deterrent that will still allow unobstructed viewing.

Unobstructed viewing can, of course, go too far and American zoo directors who feel that foreign school boys haven't the genius that American school boys show for getting in trouble, should hear of the "great raincoat escape." A few years back, a group of pink-cheeked, blue-eyed, tow-headed and raincoated Dutch school boys entered the Rotterdam Zoo and eventually made their way to a certain moated enclosure. This exhibit was filled with brown-eyed, long-haired, uncoated Gelada Baboons. The boys knotted their raincoats together, forming a long rope, and lowered the rope into the moated enclosure. Naturally, the baboons swarmed up the raincoat rope. Amazingly, they were eventually recaptured, distinguished from the school boys and returned to their enclosure. No one was injured.

In addition to truly beautiful displays, baboons, school boys and moat fences, Blijdorp is known for its success in breeding difficult wild animals. During my visit, I saw the first captive second generation (both parents born in captivity) Orang-utan ever born in a zoological garden. It was born on March 28 of this year, weighed just under 4 lbs., and is the eighth born at Rotterdam. Add to this success, a Hook-lipped Rhinoceros born in 1960 and more than 100 tigers born in the past seven years and some of the reasons for Rotterdam's reputation become evident.

Certainly the most notable private collection in Holland today is that of Mr. P. W. Louwman, at a zoo called Wassenaar. Most notable of exhibits in this fine collection is an enormous new "walk-through" aviary 216 feet long and 39 feet



WASSENAAR

The Louise Bird Hall in Wassenaar is probably the largest single, open-fronted tropical bird display in the world. It houses more than 400 birds. Visitors are confined to a roofed walk.

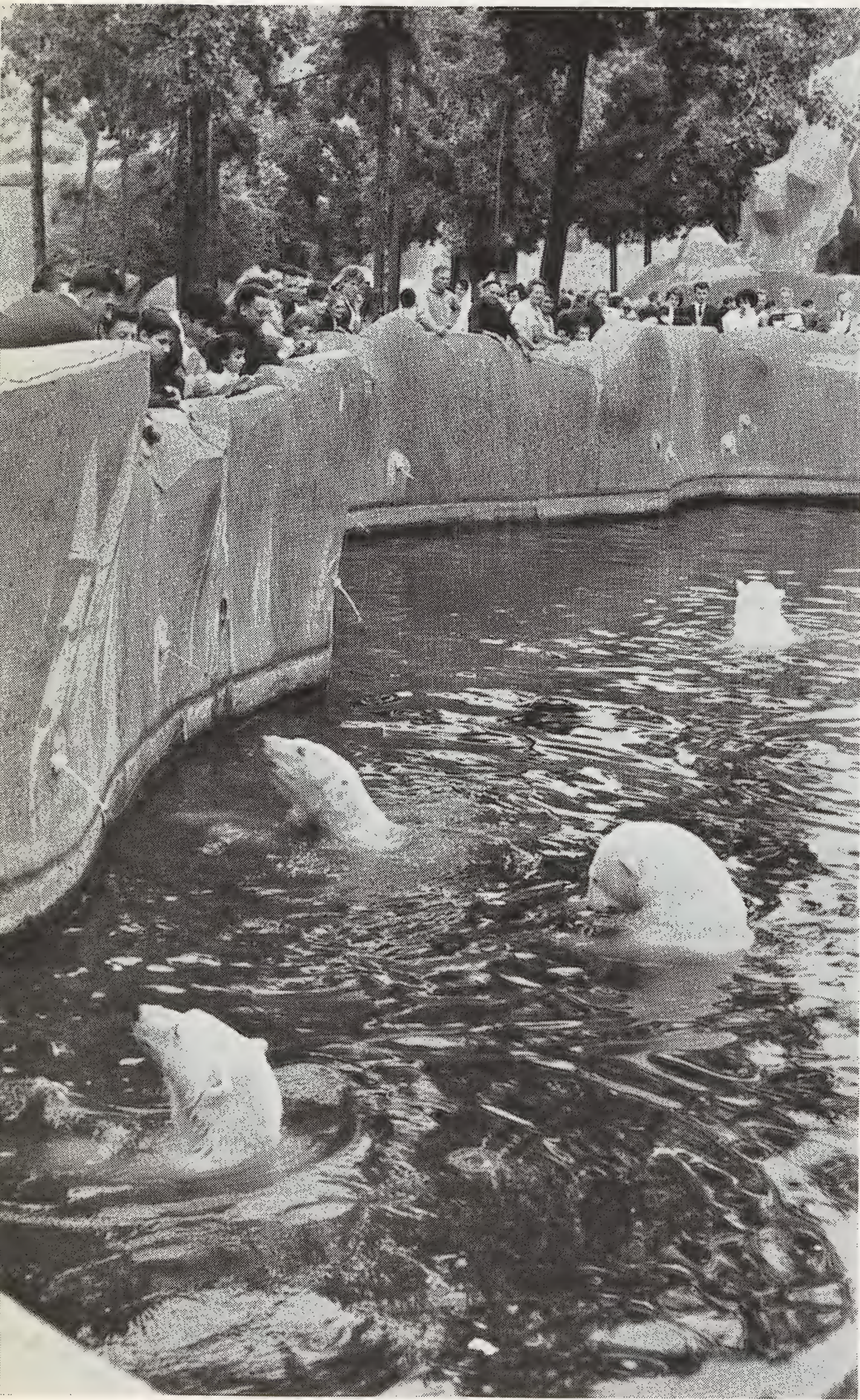
JARDIN DES PLANTES

The Jardin des Plantes in Paris is the oldest existing Zoo, opened in 1793. Prjevalsky's Wild Horses, extinct in the wild, are shown in a picturesque area.

DECEMBER 1963



VINCENNES



Parisians crowd to see the huge Polar Bear exhibit at Vincennes. A thin electric wire is enough to keep the bears from jumping up toward visitors watching them.

Vast panoramas of barless artificial rock enclosures, built in 1934, are characteristic of Vincennes. Supported by gate fees, it had 1,700,000 visitors in 1962.

wide, containing 418 birds of 112 species! Visitors are confined to one edge of the aviary, which is beautifully planted, while birds are free to fly at will in the enclosure. Mr. Louwman, as might be expected, is a born collector, and on my visit did me the honor of showing me his superb collection of rare bird books, certainly among the world's finest. And thus I was not too surprised to find among his paintings a Rembrandt, a Frans Hals and a Peter Brueghel the Younger. Somehow the Picathartes, the Great Goura and the Glossy Manucode in his bird collection did not suffer in the least by comparison.

Historically, almost all present day zoos suffer by comparison with the menagerie of the Jardin des Plantes in Paris. The botanical portion of this garden was founded in 1626 and the zoo portion, opened in 1793, was the natural outgrowth of centuries of royal zoological interests. There still stands an Elephant House built by Napoleon and, not far away, an enormous old Andean Condor bleakly regards it from the standpoint of a zoo resident who moved in in 1902. But the zoo is very small, only seven or eight



acres, and even thirty years ago it was obvious that Paris needed a major zoo.

And what zoo could be more major than the great National Zoological Park at Vincennes? It is one of the world's most spectacular animal exhibits. Vincennes, to be sure, exhibits no small birds or reptiles, but it is a vast complex of artificial rock-moated mammal displays. The sheer massiveness and scale of the Zoo, which opened in 1934, beggar description. It is hard to believe that it covers little more than thirty acres, but easy to see why most who visit it depart singing its praises. Originally the Zoo's massive rocks were the subject of much criticism. Today, with rockwork softened by time, its designers have been vindicated, and under the tasteful direction of Professor Nouvel, it is noted as a place of great beauty among exhibits of wild animals.

The words "exhibits of wild animals," in conjunction with "tasteful," inevitably bring to mind yet another Frenchman, the ubiquitous Captain Jean Delacour, who has contributed so much to the art and science of live animal exhibition. Jean, who worked at our own zoo's development

plans some twenty years ago, accompanied me around both of the Paris zoos. He provided a wealth of zoo information and invited me to see his private collection, mostly birds, at Clères in Normandy.

Clères was something of a shock. Here in the shadow of Mr. Delacour's fine old chateau, parts of which date to the eleventh century, roam blackbuck, deer, cranes, wallabies, rheas and a superb collection of waterfowl. Most of the animals are at freedom within the estate; moreover, they live within a setting that includes some of the finest ornamental plantings I have ever seen. Magnificent sequoias compete with Lebanon cedars and each vista holds some new surprise — for example, an Australian Brush Turkey nest mound under a giant cedar. Fortunately, Mr. Delacour opens his estate to the public over much of the year and last season more than a quarter of a million visitors passed through his gates. For my part, I left with my notes filled with exhibit landscaping details.

(To be concluded in the next issue.)



The Secret World of the Woods Rabbit

By LARRY PRINGLE

Associate Editor, Nature and Science

TO MOST OF US, all wild rabbits seem to be alike. The gray-brown bunnies of the eastern United States seem the same — Peter Cottontail personified.

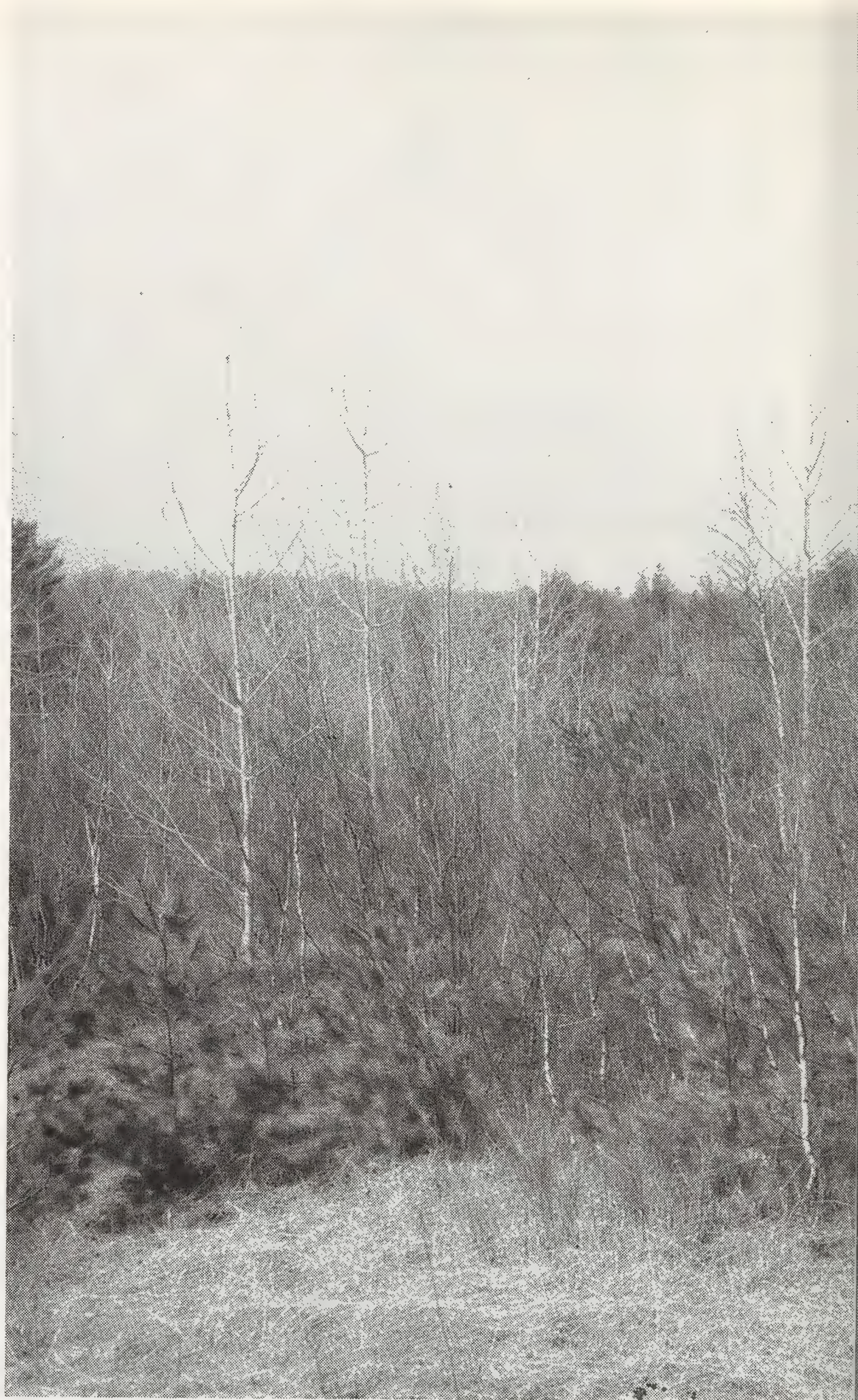
Actually, there are two kinds of cottontails living in the northeastern states. One is the Eastern Cottontail, *Sylvilagus floridanus*, which lives near gardens and in brushy pastures. The other is the smaller, darker resident of woods and thick brush, the New England Cottontail. It is called *Sylvilagus transitionalis* by mammalogists, and the two kinds of cottontails have different scientific names for sound reasons. Each species is distinct, with different color, habitat and behavior.

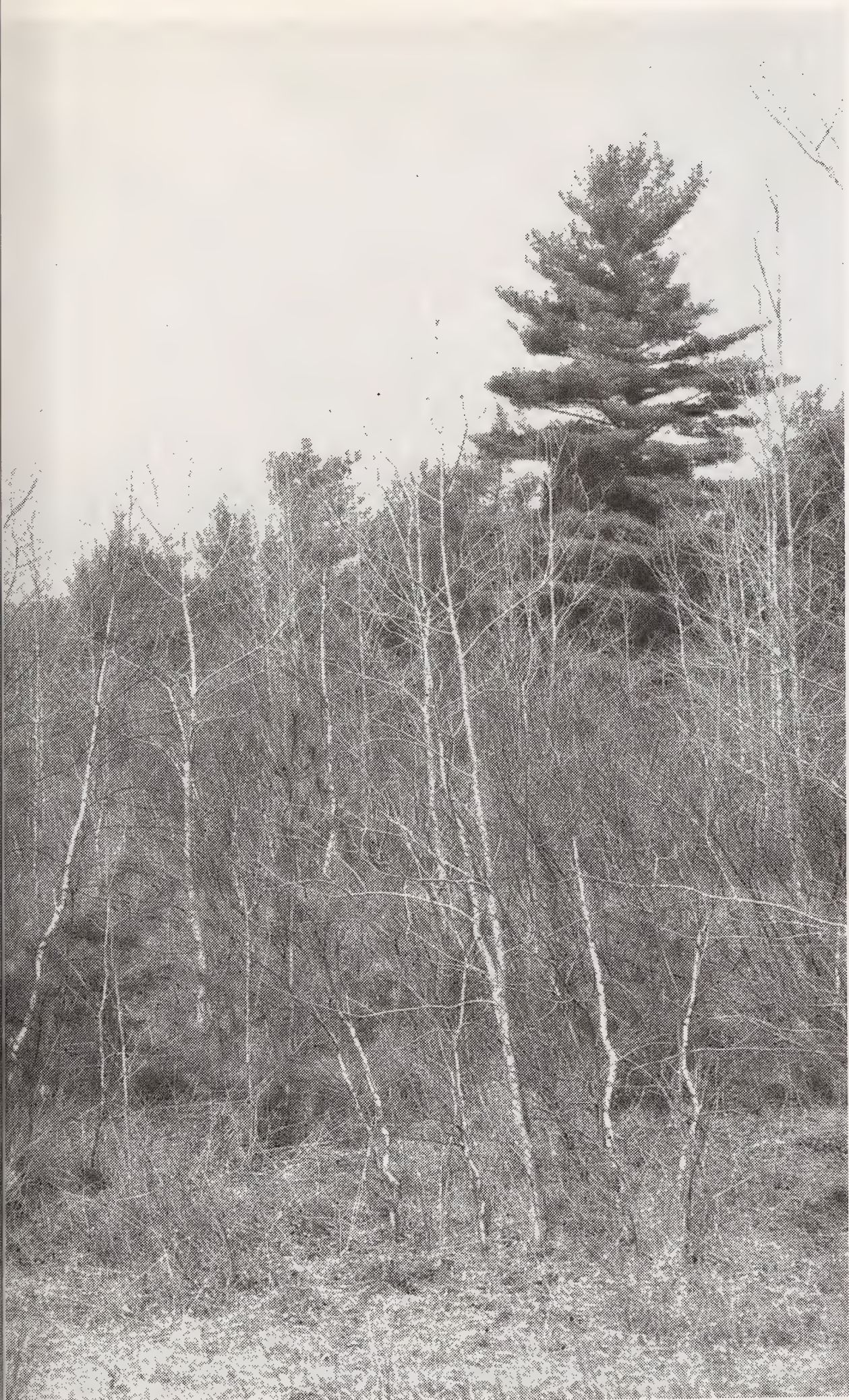
Through the years, however, scientists have learned very little about the New England Cottontail; it has become a sort of “mystery rabbit.” A few years ago I had an opportunity to study this little-known species. My research did not solve many of the mysteries surrounding the New England Cottontail, but it convinced me that wild rabbits are definitely not all alike.

The name “New England Cottontail” is misleading. “Appalachian Cottontail” would be better. The rabbit’s range extends from Maine to

Alabama and is concentrated in the mountains and foothills that are collectively called the Appalachians. In New York these rabbits are found on Long Island, in and near the Allegany State Park and along the eastern part of the state, including the Catskills, the Taconic area and the eastern Adirondacks.

Although the species is often called a “woods rabbit,” it seldom lives in mature woodlands, but apparently thrives in young woods that have openings and ground cover. In colonial times New England Cottontails were probably more widespread, if not more plentiful, than now. When settlers cut openings in the forest canopy, these rabbits prospered on the openings’ edges. However, as entire forests changed into farmland, the range of the New England Cottontail began to shrink.





New Hampshire and found that they were all the dark little woods rabbits. He caught no Eastern Cottontails north of the lower Hudson Valley. Today, Eastern Cottontails are more plentiful than New England Cottontails in Connecticut and Massachusetts.

Bangs also noted a difference in the habitat of the two rabbits. He seldom found New England Cottontails in open fields, but caught them in thick swamps, brier patches and overgrown pastures. He suggested that the color of the two rabbits was different because of their differing habitat. Eastern Cottontails, blending into the cover of grasses, weeds and low brush, are light gray-brown. New England Cottontails, hiding in the darker cover of thick brush and young woods, are reddish-brown with many scattered black hairs.

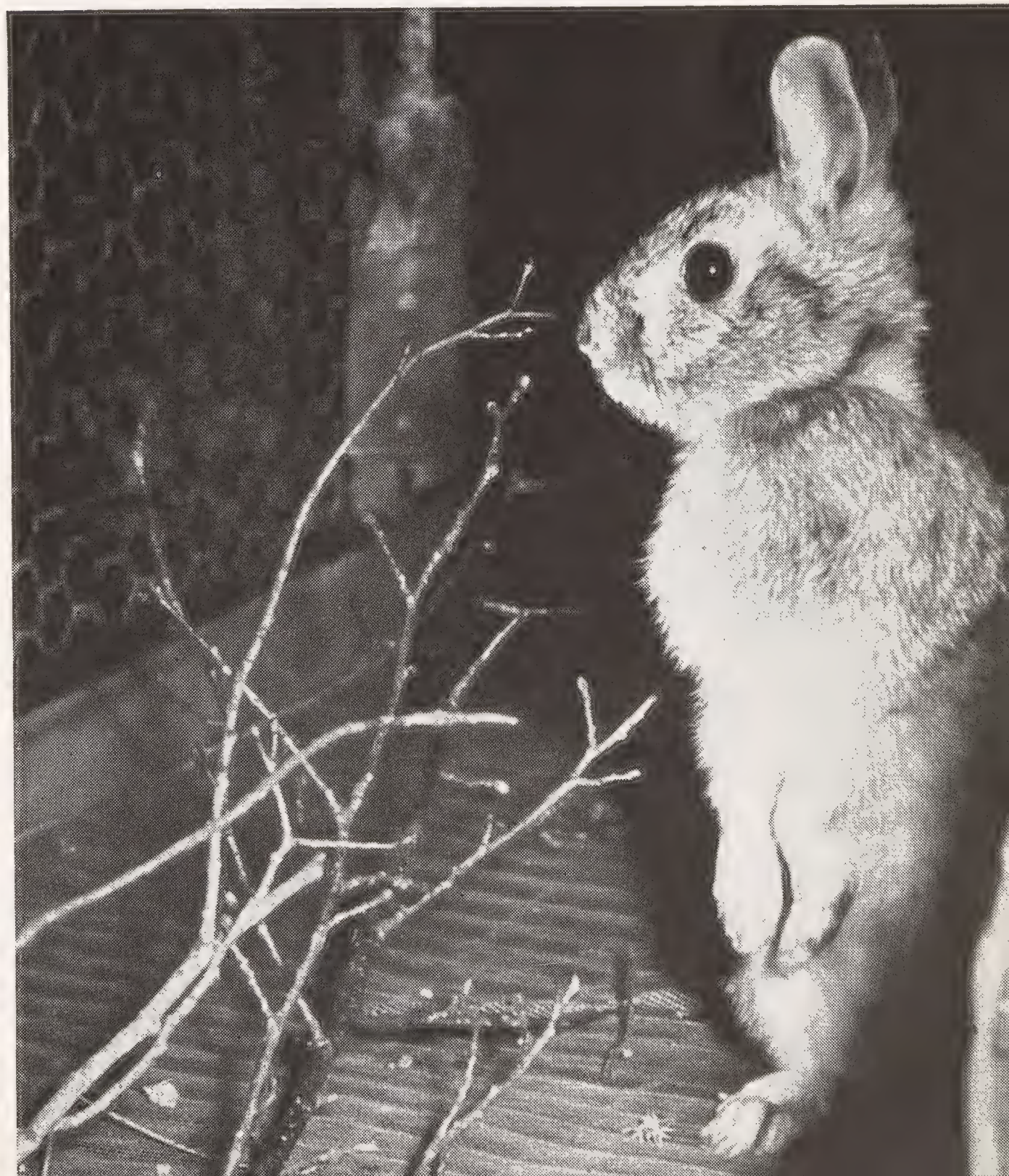
Besides the general color of their pelts, there are other ways to tell these rabbits apart. Not all of them are physical differences. Shortly after beginning my research at the University of Massachusetts, I learned about some of these other differences. I set about a half-dozen box traps in an area that was covered with thick second-growth woods and berry thickets — likely-ap-

New England Cottontails shun open land and are found in dense brush, thick swamps and fields overgrown like this one. Below: Typically, a New England Cottontail stands to look.

Both photographs by the author.

The animals that slipped into the rabbit niche on the farms and in gardens were Eastern Cottontails, whose cover needs are met by low brush, shrubs, fencerows and brush piles. Today, Eastern Cottontails are far more plentiful than their woodsy relatives, and that is one reason why so little is known about the New England Cottontail.

Some of the best information about the species was published 70 years ago by the naturalist who first described the New England Cottontail, Outram Bangs. His 1894 paper ("The Geographical Distribution of the Eastern Races of the Cotton-tail. . ."), not only described the new species, but gave a partial view of the range of both Eastern and New England Cottontails at that time. For instance, Bangs trapped hundreds of cottontails in Connecticut, Massachusetts and



pearing woods rabbit cover. However, this area was bounded by grassy meadows, which would also attract Eastern Cottontails. Both kinds might be caught, so I checked various mammal guides to help identify the captures.

Soon I had a mental checklist of characters to go over when I had a rabbit to examine. First, look for a white spot in the center of the rabbit's forehead. About half of the Eastern Cottontails have this spot; no New England Cottontails do. If the white spot is lacking, look between the rabbit's ears. Eastern Cottontails have a dark brown spot there; woods rabbits have a black spot. And so on down the list. The shape of the ears and the color and amount of hair on them are subtly different in the two kinds of rabbits.

Before trapping began, however, I was warned about another difference between the rabbits, one that is not mentioned in field guides. That is handling behavior. Some biologists who had studied both rabbits — handling them for ear tag-

ging — found Eastern Cottontails “docile,” and New England Cottontails “aggressive.”

The first rabbits captured were Eastern Cottontails. Inexperienced in the techniques of keeping rabbits calm while tagging their ears, I found that these “docile” ones kicked, squirmed and scratched. Could the woods rabbits be any worse?

I caught one. Seconds later the rabbit hopped away — untagged — leaving me with a scratched and bleeding wrist. I did manage to tag others, and usually found them harder to handle than Eastern Cottontails. Moreover, once the woods rabbits were freed, they were apt to hop off a few yards, sit down, and then watch me. Eastern Cottontails always fled for cover at top speed when released.

Later in the study I kept several individuals of both species in cages, and they showed other behavioral differences. Even after months of captivity, Eastern Cottontails were easily frightened and bolted around their cages at the slightest

Head and ear characteristics vary in the two Cottontails and are illustrated here. One obvious point is between the ears — dark brown in the Eastern, black in the New England.

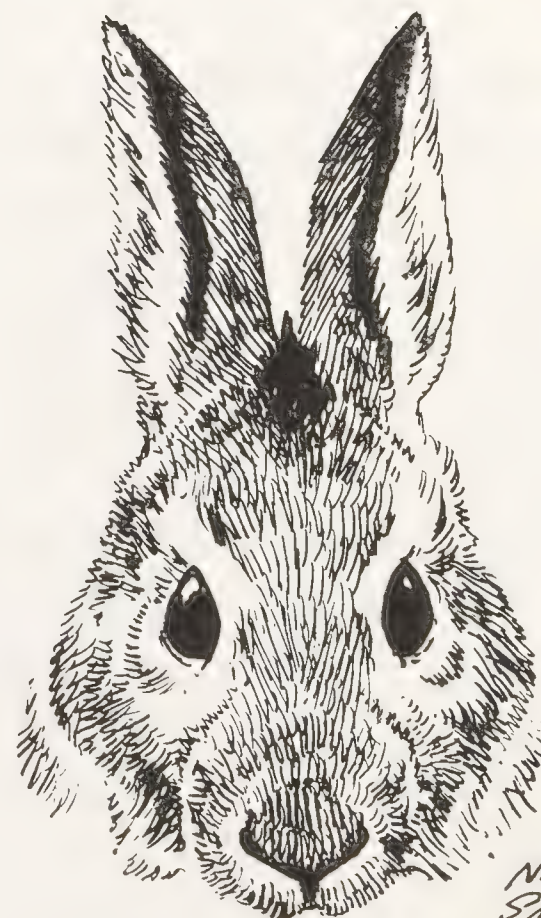
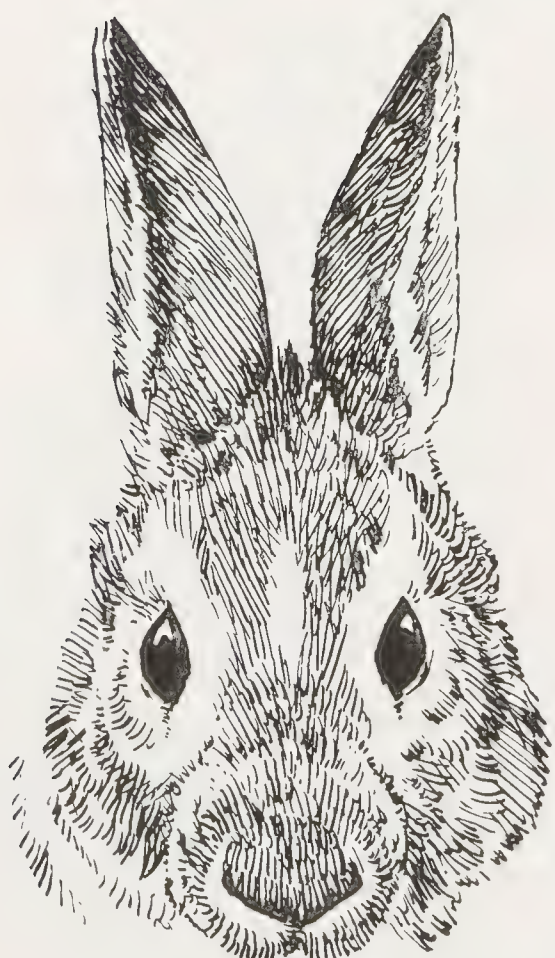
Drawings by Ned Smith, courtesy of Pennsylvania "Game News"



**Eastern
Cottontail**



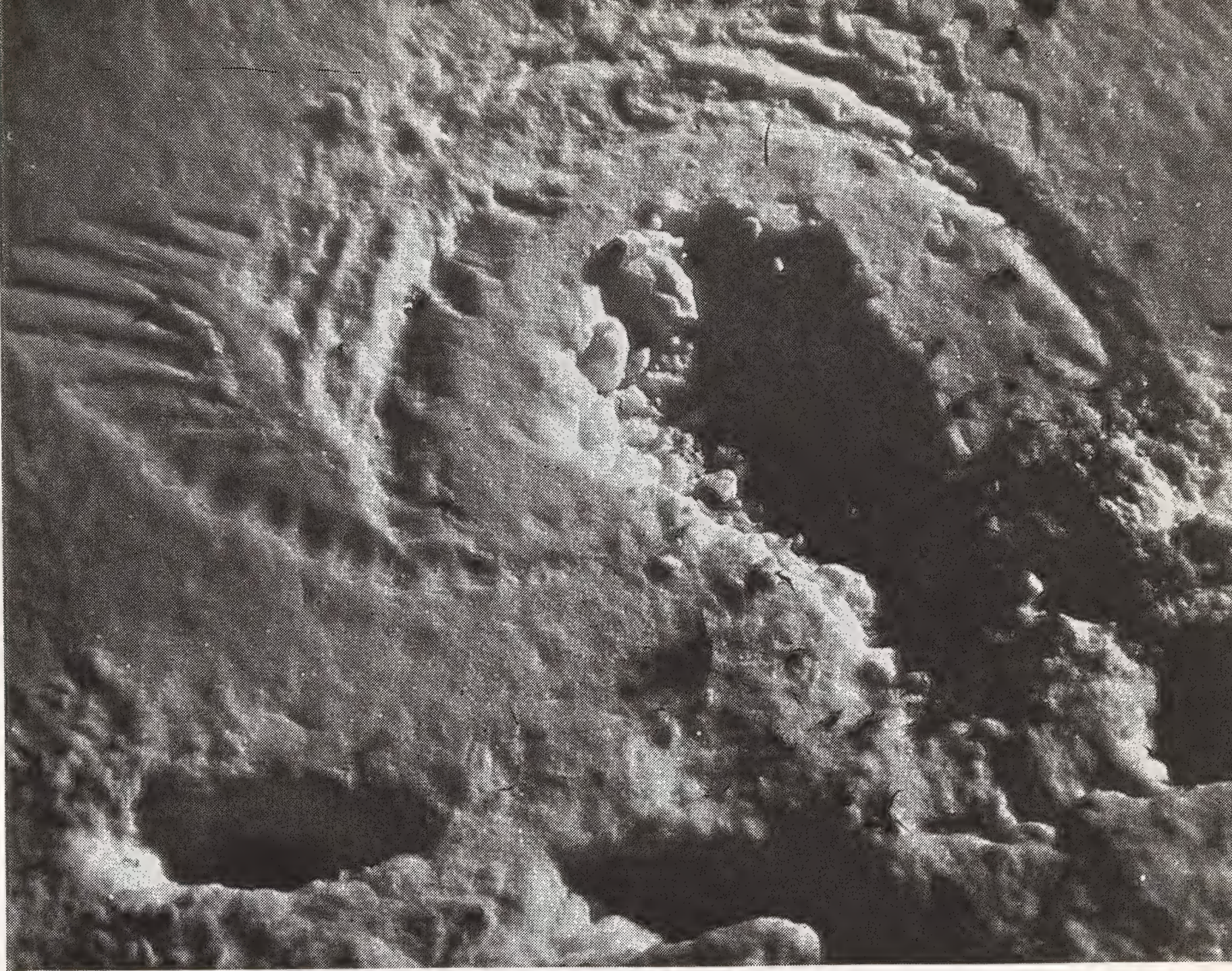
**New England
Cottontail**



NED
SMITH

Cottontails are staple food for many predators. Here a Great Horned Owl has caught a New England Cottontail in the snow, leaving scattered bits of fur.

Photograph by the author.



disturbance. Conversely, New England Cottontails became tame and were more apt to stand on their hind legs for a better look than to run for cover of the nest box.

There is one other behavioral difference between these rabbits that I noticed: some of the woods rabbits "ticked." This peculiar sound was made when the rabbits were excited or frightened. I once frightened a woods rabbit while cleaning its cage. It began to tick and three other nearby New England Cottontails joined in. Another time a male woods rabbit was put into a female's cage in an attempt (unsuccessful) to breed them in captivity. Both began to tick.

Some woods rabbits ticked while in traps, or when released from traps. The sound may have been made by clicking teeth together. At times, however, it seemed to have a squeak mixed with the ticks, so the vocal chords may have been used. No Eastern Cottontails — in cages or traps — ever made this sound.

The rabbit's behavior was a valuable aid to identification, because not all of the rabbits were easily identified by external physical characters. I recall one rabbit that seemed to have all of the light pelt markings of an Eastern Cottontail. However, I called it a New England Cottontail on the basis of its ticking sound in the trap and later tame behavior in a cage. When it died, a look at some skull characters — the last word in identification — showed it to be a New England Cottontail.

I trapped cottontails in central Massachusetts for parts of two years. Some rabbits were tagged and released, others were caged for study of behavior and food preference, and some woods rabbits were dissected to learn about their reproduction. Trapping rabbits is never dull, but it can be frustrating. Using apple as bait, it was easy to lure rabbits into traps from early March to late May. From then on, trap success fell because the rabbits had plentiful vegetation to munch on. Part of the adventure of trapping was in carefully opening the box traps to see what had been caught. Besides cottontails, the catches included skunks, porcupines, snowshoe hares, woodchucks, chipmunks, weasels and red, gray and flying squirrels.

The food preference of rabbits was studied by giving several caged individuals of each species a choice of two food plants. In summer, two different plants were put into a container in a rabbit's cage. The plant that was eaten most was judged preferred. Then the preferred plant was tested on other rabbits, and compared with other plants. In winter, twigs of woody plants were tested the same way.

These studies showed once more that the Eastern and New England Cottontails are indeed different animals. Some woody plants which are preferred food for one species are merely emergency food for the other. For example, winter twigs of apple and aspen, eaten readily by Eastern Cottontails, were shunned by woods rabbits.

Three-quarters of Massachusetts has populations of both Eastern and New England Cottontails. The other quarter — most of the Berkshires and the north-central region — has a pure woods rabbit population. In these areas the New England Cottontails often share laurel thickets and spruce swamps with snowshoe hares. Most biologists believe that it is the climate — and its effect on vegetation — that excludes Eastern Cottontails from these parts of Massachusetts and the rest of northern New England.

In most of Massachusetts the two species can be found living side by side. When two undergraduates at the University of Massachusetts trapped the rabbits in a 10-acre plot near the campus, they caught New England Cottontails in and along the edge of a young hardwood forest, and Eastern Cottontails in a juniper-studded meadow that skirted the same woods.

In another part of the state, game biologist James McDonough has caught both species of rabbits in adjacent traps. Some of his trap sites consistently yield one kind of rabbit and not another. He finds that the New England Cottontails are usually caught in areas where the vegetation or "overstory" plants are highest.

Game managers are still puzzled over how to improve habitat for woods rabbits. So far, no one has scientifically defined "ideal" woods rabbit habitat. Usually creating grassy edges, openings and brush piles gives Eastern Cottontails the combination of food and cover they need. However, when this management is applied to areas where both species exist, Eastern Cottontails increase while the woods rabbits decrease.

Since the two species sometimes live close together, the question often arises: Do they interbreed? Outram Bangs wrote that he found one case of natural interbreeding in Pennsylvania. Since then, the two species have been mated in captivity. Some young were born, but they soon died. Most biologists assume that there is little interbreeding in the wild.

To learn something about reproduction of woods rabbits, 30 females were collected during the March to September breeding season. Apparently woods rabbits are as prolific as other cottontails. Their breeding season may begin later than that of some Eastern Cottontails, because winter lingers in the wooded hills where

many New England Cottontails live. Once started, a female woods rabbit may bear three to five litters a season and three to eight young per litter. The average litter size is about five.

Recently an Illinois biologist pointed out that the number of young produced by rabbits — and many other animals — seems to vary with latitude. Rexford Lord, studying Illinois rabbits, found that the farther north rabbits lived (and the harsher the climate), the larger their litter size. The climate of the eastern seaboard is moderated by the ocean, however, and is more mild than inland areas of the same latitude. Thus the average litter size of woods rabbits is slightly less than that of cottontails in Pennsylvania and Ohio.

Many rabbits must be produced to offset losses to diseases, parasites, hunters and accidents. Cottontails are a staple food for many predators and seldom live more than a year. However, the results of James McDonough's trapping studies show that New England Cottontails survive longer than Eastern Cottontails, at least in parts of Massachusetts. After trapping, tagging, releasing and retrapping cottontails for years, he has found that 50 per cent. of woods rabbits lived at least six months after being released. Only 27 per cent. of the Eastern Cottontails lived that long. One female woods rabbit was retrapped for five years; it may well be an old-age record for wild cottontails.

The most obvious explanation for the longer lives of woods rabbits is their attraction for thick cover. Wherever the two kinds of rabbits co-exist, it seems more likely that Eastern Cottontails will be flushed by a hunter, spied by an owl or crushed by a car.

Currently, New England Cottontails are again being studied at the Wildlife Research Unit of the University of Massachusetts. Game biologists still hope to learn specific facts about what kind of cover woods rabbits need, so both species are being introduced onto a wooded island in a large reservoir. The 14-acre island is divided in half by a rabbit-proof fence, and a detailed study of the vegetation has been made. Now some Eastern Cottontails are being stocked on one side of the island, and woods rabbits on the other. This study may lead to the first real facts about woods rabbit habitat — one of the best-kept secrets of the New England Cottontail.



The Good Life on Lion Island

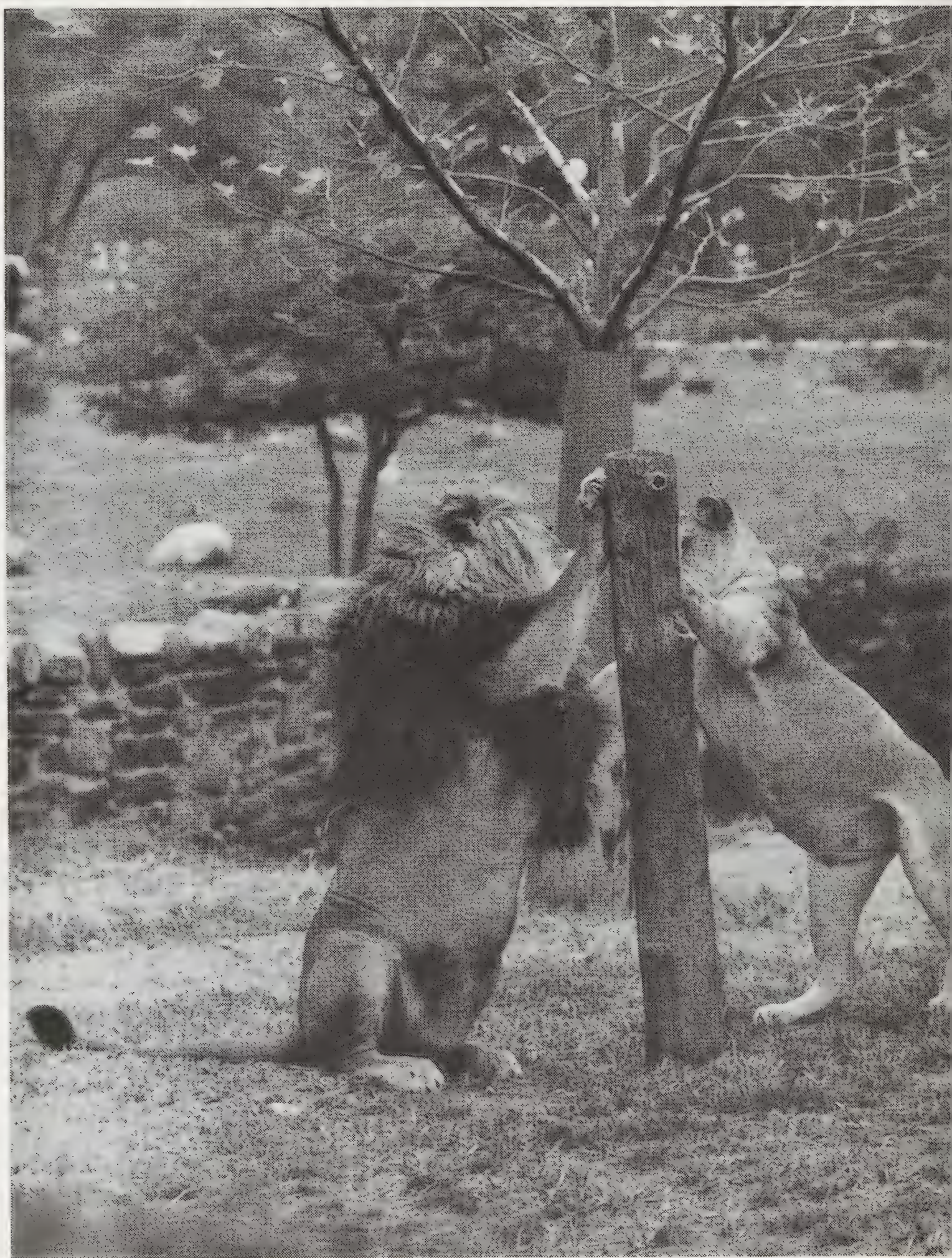


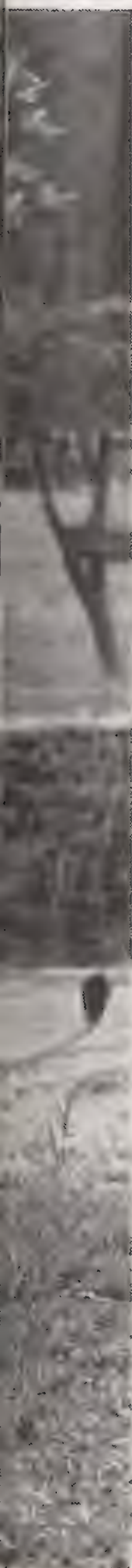
Photographs by EMMY HAAS





Sometimes photographs need no explanatory captions, and this is one of those times; the happy family life on Lion Island in our African Plains exhibit is self-evident. The cubs, a male and a female, were born on August 1 and made their first appearance outside the shelter house on September 11 with their mother. Within a very few days they knew their way around the island and, with the playfulness of all cubs, found plenty to amuse themselves — especially the tail-tufts of their parents. Miss Emmy Haas spent several autumn weekends photographing the family and these are a few of her hundreds of scenes of a lazy and carefree life.





*A Giant Step
Toward Keeping*

Giant Chameleons

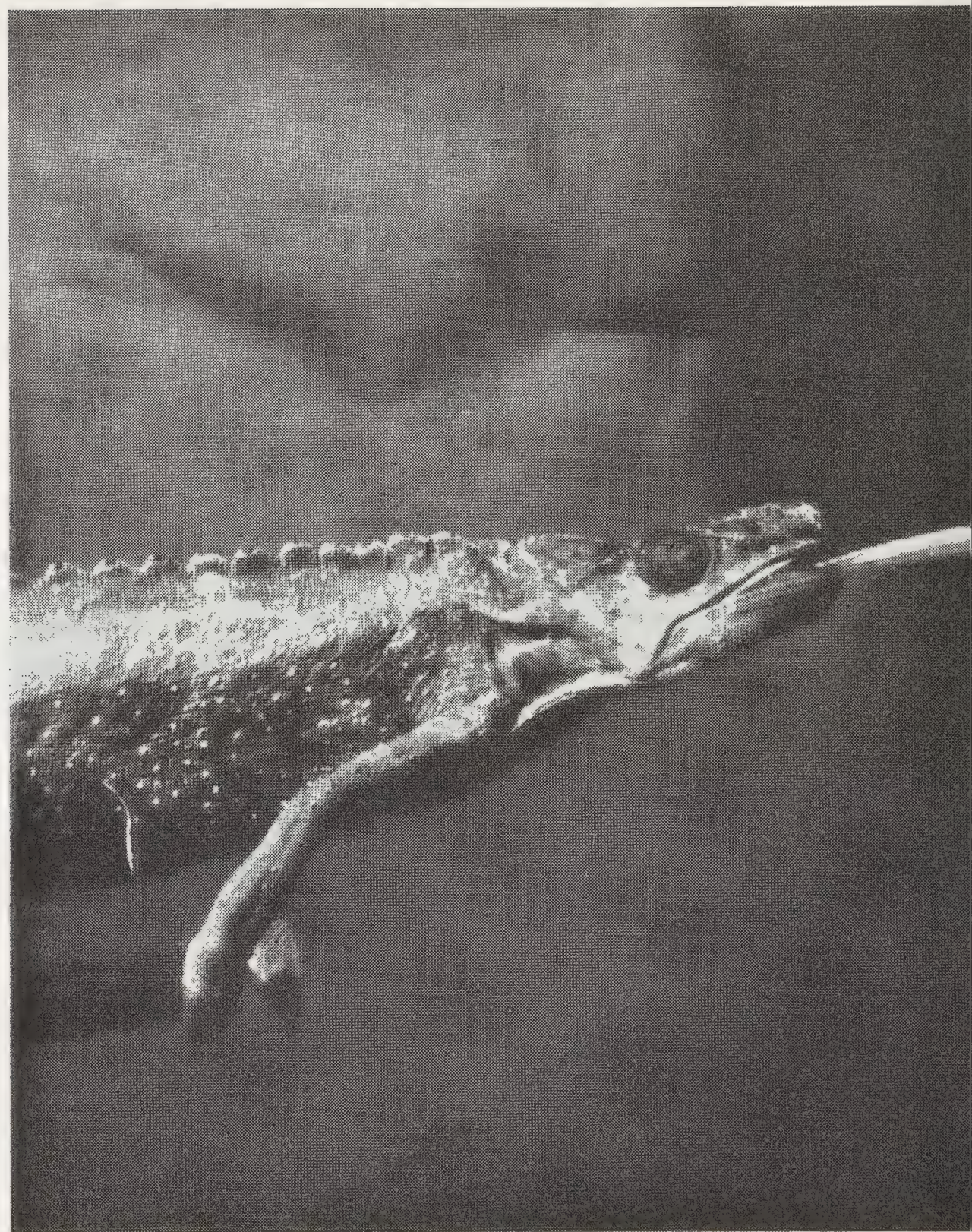
By HERNDON G. DOWLING
Curator of Reptiles

ON SEPTEMBER 18 the Scandinavian Airlines brought us a small crate from East Africa. "Live Reptiles, Keep from Heat or Cold," it said, but the tag gave no further indication of its contents. It had been sent to us by Mr. Jonathan Leakey, of Nairobi.

This same Mr. Leakey had visited us at the Zoological Park last year. Son of that famous discoverer of ancient man, Dr. Louis S. B. Leakey, he has been making a place for himself as a student of reptile life. But we had not ordered anything. Could this be a sample shipment?

Upon opening the crate, my heart sank. There were ten, no, *eleven* African Chameleons! Large, green and yellow hued, and with bulging eyes, they seemed to be in the prime of health. As they slowly disentangled their tails and stretched out their parrot-like zygodactylous feet, I sat back to consider their dim prospects.

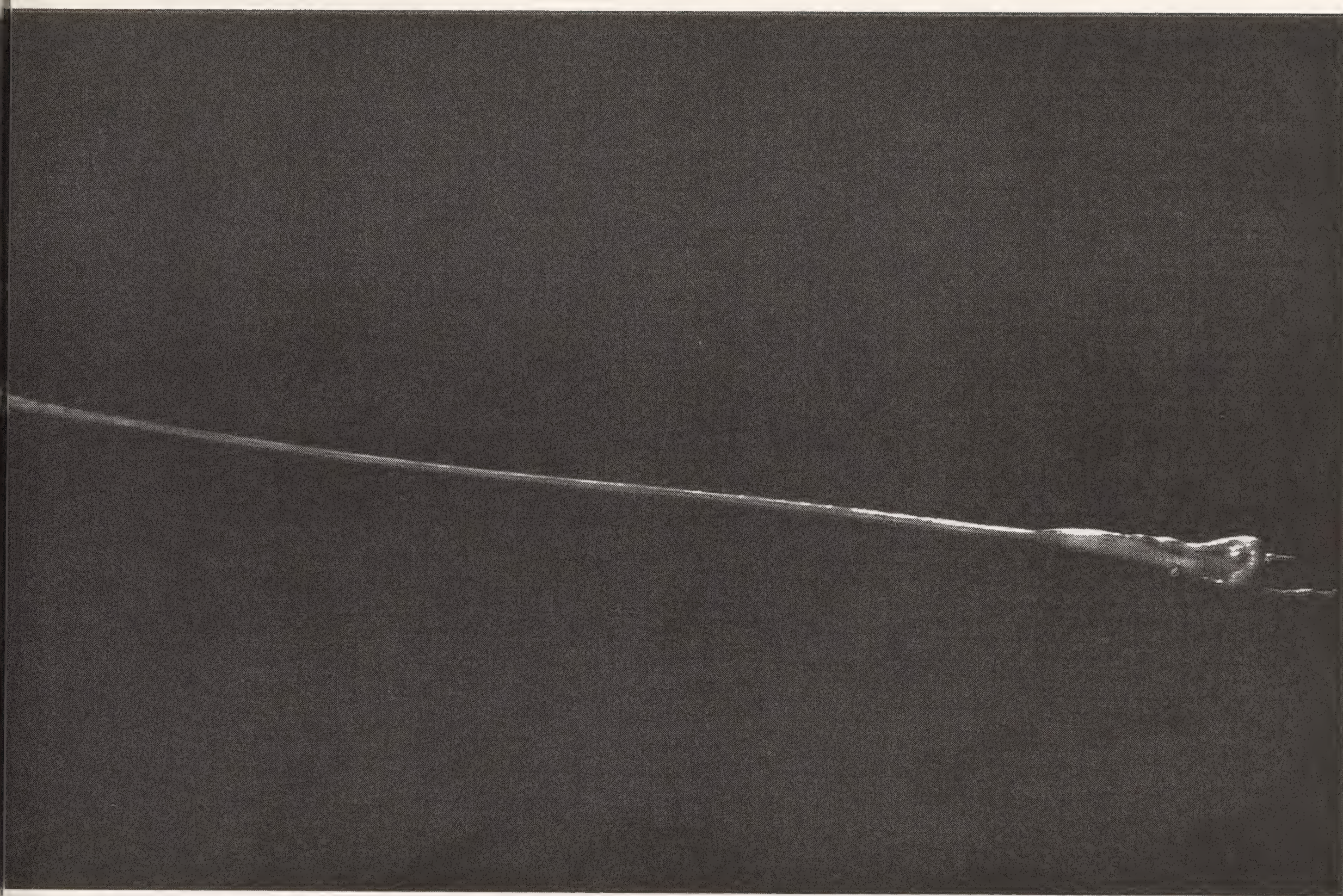
Chameleons are among the most interesting of all reptiles and provide exhibits that are especially colorful and instructive. Nevertheless, at this point I would not have ordered a *single* chameleon for exhibit in the Reptile House, much less nearly



a dozen. We had received only a few individuals of these bizarre lizards in the time that I had been at the Zoological Park but their records of longevity had not been, to put it kindly, outstanding. We had tried keeping them warm and tried keeping them cool. We had changed their length of day and tried the effect of sunlamps. They had been fed mealworms, flies, roaches, crickets, and even (in the case of a very large specimen) small mice.

They fed ravenously at first, taking almost anything that was offered. After a couple of weeks, though, they became lethargic, they lost interest in food, and began to fail in health. Finally, their huge turreted eyes would sink into their head, and the next morning they would be dead. Most such chameleons lived only a few weeks at the Reptile House. None survived more than a month. It was this appalling prospect that I faced — loss of an outstanding collection of animals in a month's time.

Nevertheless, we had eleven chameleons on hand and we must make the best of it. These were of the Giant African species, *Chamaeleo*



melleri. Some of the individuals were a full eighteen inches long and, at least for a brief time, would provide an outstanding exhibit.

A quick survey of the Reptile House exhibition areas indicated that the first lobby enclosure was perhaps the best. Dispersing its fauna of geckos and iguanas to other cages, the enclosure was cleaned, given a quick coat of maroon-colored spray paint, and refurnished with white beech limbs and a white marble-chip floor. The job was finished that very afternoon. The decorations were the converse of our usual "natural background" exhibition techniques, but it was spotlighted to set off the brilliant greens and yellows of the chameleon giants in dramatic fashion.

The chameleons were introduced to their new quarters the next morning, and they did look grand! By now, *via* cable, we had a part of the story of their unexpected arrival. President Osborn, in his East African travels, was told by Dr. Leakey of the collection of reptiles his son had made. Visualizing the outstanding exhibitional value of the giant chameleons, he had purchased the entire lot for the Zoological Park.

African Chameleons have the ability to "shoot" their tongues to improbable lengths — as much as 10 inches — to capture insects. This specimen has just picked up a cricket.

Photograph by Russ Kinne.

With the imminent prospect of losing the entire group, I was determined to obtain whatever value could be secured during their brief stay. Newspapers were notified of the new exhibit, *Life* magazine sent up a photographer to make a color spread, and I asked our own Staff Photographer, Sam Dunton, to get some black-and-white shots and a moving picture record of their feeding activities.

Meanwhile, a thousand extra crickets had been ordered and were being consumed at a rate of almost twenty-per-day-per-animal. By virtue of the chosen enclosure's position, the chameleons had come under the special care of Keeper Robert Brandner of Bushmaster-keeping fame (*Animal Kingdom*, Volume 64, No. 5, September-October, 1961). He watched carefully to make sure that each individual got its fair share of crickets, and it was he who first noticed that a missed shot at

a cricket often gave the hungry chameleon a mouthful of chipped marble from the floor, which the lizard then proceeded to swallow. A coarser gravel, not so dramatic in appearance but not so likely to be swallowed, was substituted immediately.

Two weeks passed by without incident. Thousands of people came especially to see the chameleons. The animals continued to eat well and the cricket order had been regulated to 500 crickets on Mondays, Wednesdays, and Fridays (other lizards, frogs, and a Green Snake accounted for some of these). At the beginning of the third week, though, two of the chameleons seemed to be spending an unusual amount of

time on the ground. And was it my imagination, or were their eyes a little sunken?

It was at this point that Paul Breese, Director of the Honolulu Zoo, dropped by the Park on a quick visit. Among other things, he mentioned that he was keeping some European Chameleons (*Chamaeleo chamaeleon*) at the Honolulu Zoo and had them for about five months. Although the Hawaiian climate is not too different from that of the Mediterranean region from which his chameleons come, I questioned Paul closely — hoping that I might find some clue in their care that would be helpful to our operation at the Reptile House.

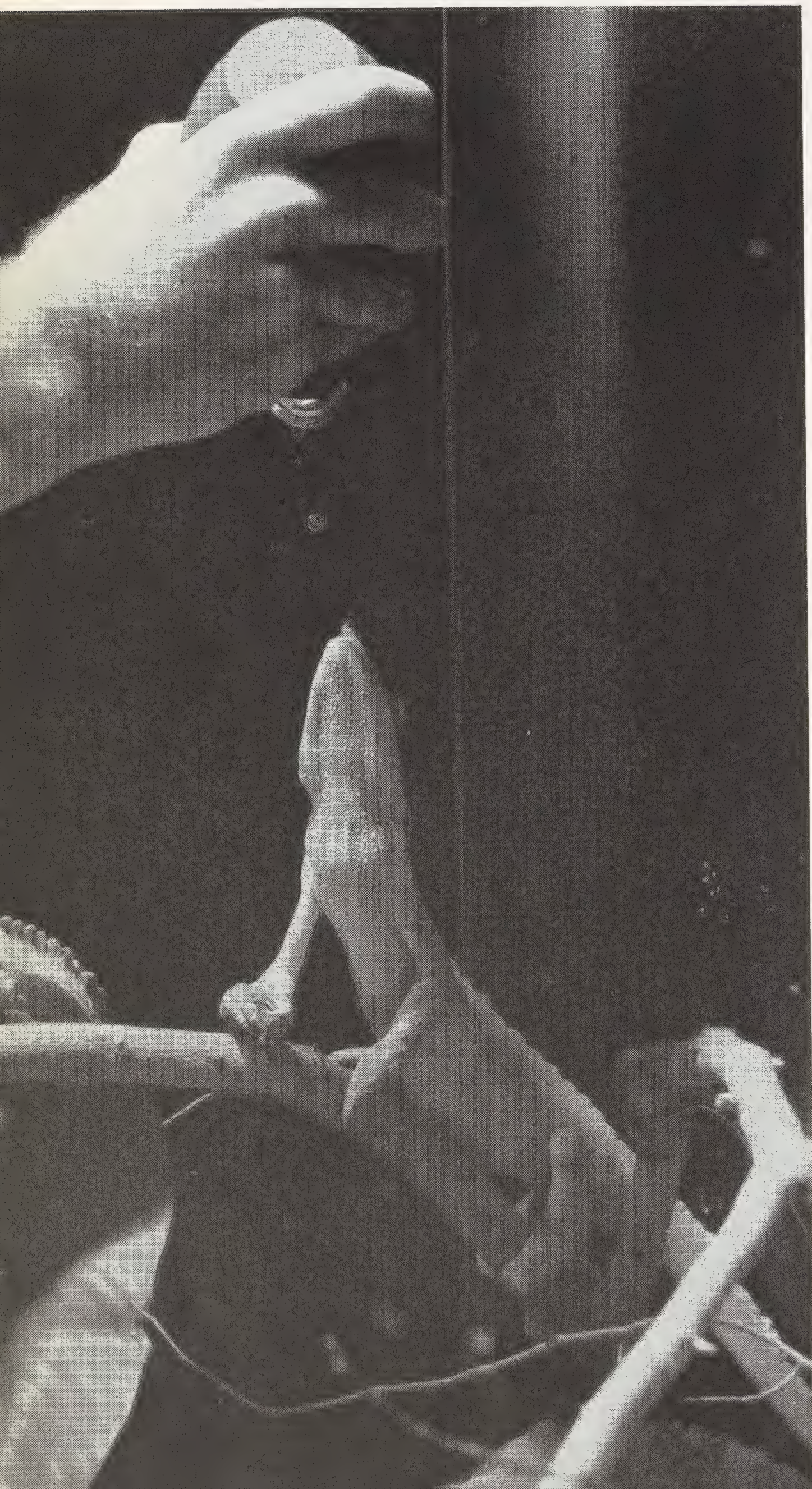
I was concerned about the lack of variation between night and day temperatures in the Reptile House, being sure that there must be a ten-to-twenty-degree drop at night in the Giant Chameleons' East African habitat, Paul agreed that this might be a factor, describing how his chameleons dodged the direct sunlight after the first few rays of morning. We went over other aspects of care and finally closed the discussion without my feeling that I had found that long-sought-for clue. And then, just as he was leaving, Paul remarked, "Say, don't they drink a lot of water!"

I nodded in agreement and then, after he was gone, began to think, "Do they really drink a lot of water?" I had seen one occasionally lapping water out of the bowl on the floor of the cage — but certainly not enough to be surprised by the amount that they consumed. Bob Brandner confirmed my observations. One chameleon might occasionally drink from the water dish but there was certainly no traffic in its direction.

"What about spraying the enclosure?" I asked, thinking that perhaps these arboreal animals were more accustomed to finding raindrops on the surrounding leaves than they are accustomed to drinking from a pool. Bob informed me that he had not sprayed the enclosure. One of the local reptile dealers who had had some experience with chameleons had warned against this practice some years ago. With the Reptile House's poor record of maintaining these creatures, it did not seem

Catching drops of water as they fall, a chameleon manages to take in a surprising amount of water. This method of watering makes all the difference in keeping them.

ANIMAL KINGDOM



worthwhile to try something that he had been warned against.

"Let's try it, anyway," I insisted. Under my watchful eye Bob began to drop some water over the birch-limbs and chameleons. The whole group began to stir. Before our eyes the chameleons threw aside their lethargic ways and actively pursued the drops of water, lapping them avidly from the limbs. And they could not get enough! The more we dripped (for I had joined Bob by now), the more anxious the chameleons were for more water. The climax of the episode came when Bob had three chameleons lapping up the water he slowly dripped into the palm of his hand and I had another three with heads raised and their mouths wide open, waiting for me to drop water directly into their parched throats.

Such is the animal business! A chance word or a chance observation can make the difference between maintaining some rare and exotic animal instead of being responsible for its death. In this case, the results were delightful — and humiliating too. While we are glad to have saved the present group of chameleons, we cannot forget

those previous individuals, dying of thirst with a water dish in plain sight, while we concentrated on changes of food, of temperature, and of lighting.

We are long past the one month deadline that we had anticipated when the chameleons arrived, and the group is still surviving and even beginning to show some social interaction. We have set up a couple of blood-plasma bottles, with their adjustable rates of flow, to drip water into the cage for certain periods of the day so that it does not all have to be done by hand. It may be that we still have not learned *all* of the factors necessary to maintain chameleons in captivity, but we have made a giant step in that direction.

With the discovery of the dripping-water technique, we have ushered in a new era of chameleon-keeping in our Reptile House, and perhaps our observations will be helpful to the keeping of these exotic and grotesque animals in other American zoos as well. I know of no other exhibit of these animals in the United States.

You know, those chameleons *do* drink a lot of water!

Seniors of the Wilderness

By MARGARET ALTMANN

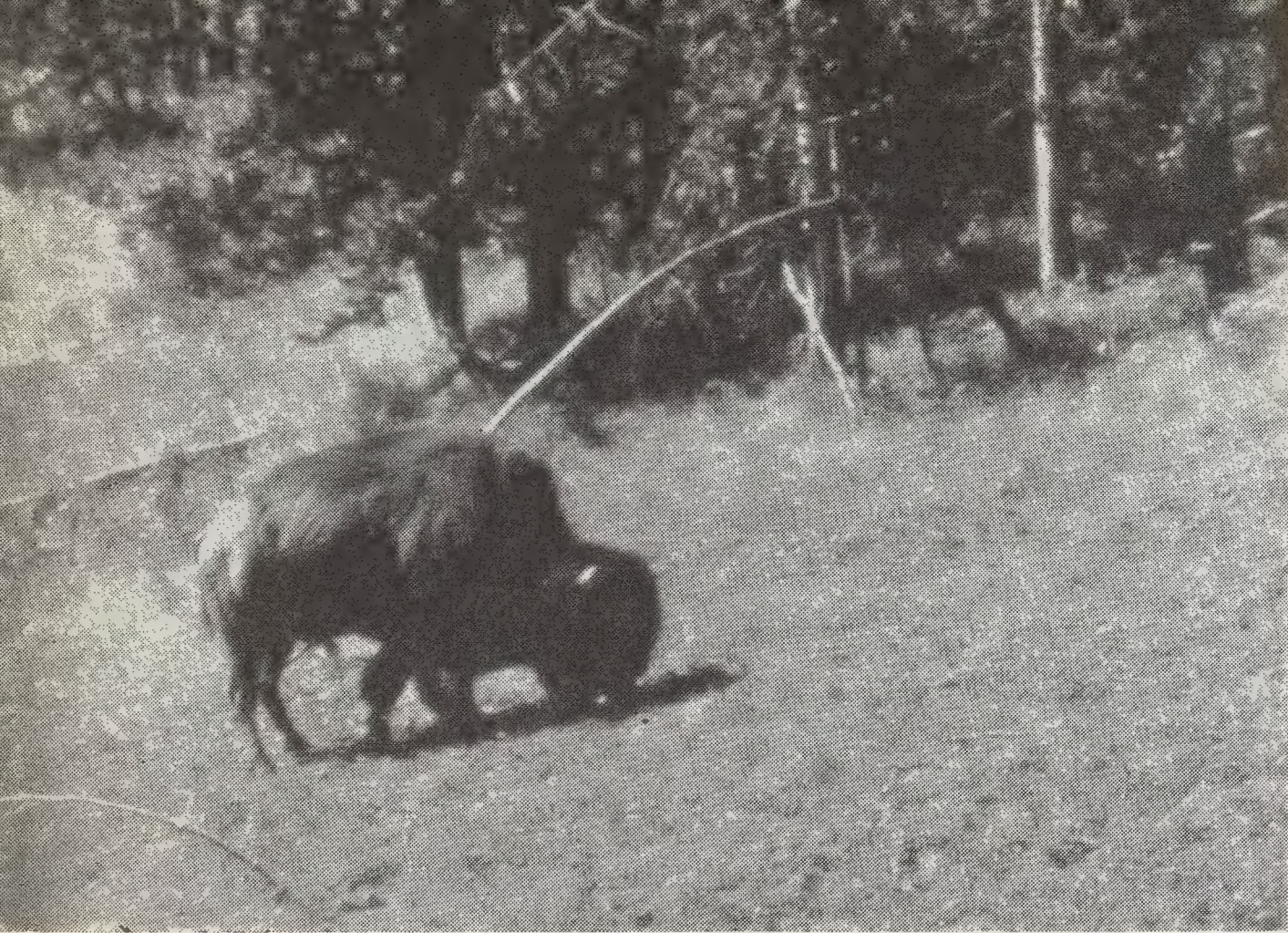
University of Wyoming

NEWSPAPERS and government reports have made us all familiar with the term "senior citizens" and with their special problems in relation to family and community life. Much is, indeed, being written about, and done for, the elderly human being, but there is very scant information about the social role of the older animal in wilderness groups — and yet certain animals have their own solutions to the "problems" of their own senior citizens. In the past year or so I have been studying these, under the general title of "The Social Role of the Aging Ungulate."

Our observations were at first concentrated on the magnificent American Bison (*Bison bison*)

living in herds in Wyoming and Montana. Stories of old, lone bison living apart from the herds are common enough but to our surprise we found that theirs is seldom a simple, uncomplicated existence on their own.

These old bison bulls may be found in the deep forest and sometimes even on the trails or in clearings in the timber. Treat them with extreme caution, no matter how immobile they look or how indifferent they may seem to be to you as an intruder! They look, in fact, as solidly rooted as old tree stumps, but despite their age and their apparent dignity, they may suddenly come to life with a quick turn and a rush toward you.



This old Bison bull is away from the herd and foraging by himself. Indifferent as old bulls may seem to be, they are capable of making a furious rush when an intruder gets too near.

Photograph by Steve Martin.

Isolated as they are, there are a number of variations in the social behavior of the old bison. These indicate various degrees of detachment from the herd life as it is lived by the young and mature animals of the species.

One of these is the "outrigger" position of the old bull. He has left the herd, either because of a threat by a younger bull or because of the pressure of rough combat, and moves into what can be called a marginal position in relation to the herd. As an outrigger, he lives within scenting, hearing or visual distance of the herd and can thus share its major movements. Actually, as we often observed, he may temporarily rejoin the herd and leave it again. Essentially he is part of the herd, but not regularly in it. Why? Is he fed up with family life? Are the noise and commotion finally too much for him to endure?

Another solution for an old bison bull is to "adopt" one or two young, roaming bison bulls who become his partners or "satellites." The old

An elderly bull Moose, with a younger bull in the lead. Such associations are common in the rutting season but are not as durable as the regular Moose groupings at other seasons.

Photograph by the author.



one is the boss of this group and determines when and where to go; the young ones seem to accept this relationship with ease and stay for various periods of time to share the experience and security the old bull provides.

A few old bison bulls have found still another solution to their seniority; they manage to retain their herd position despite their obviously advanced years. Their previous position must have been a high social rank in their group, and they continue this rank seemingly without being challenged. There are distinctions here that we cannot yet recognize or understand, for plenty of other bison bulls do retreat from the stresses and noises of herd life and take up a solitary existence when age catches up with them.

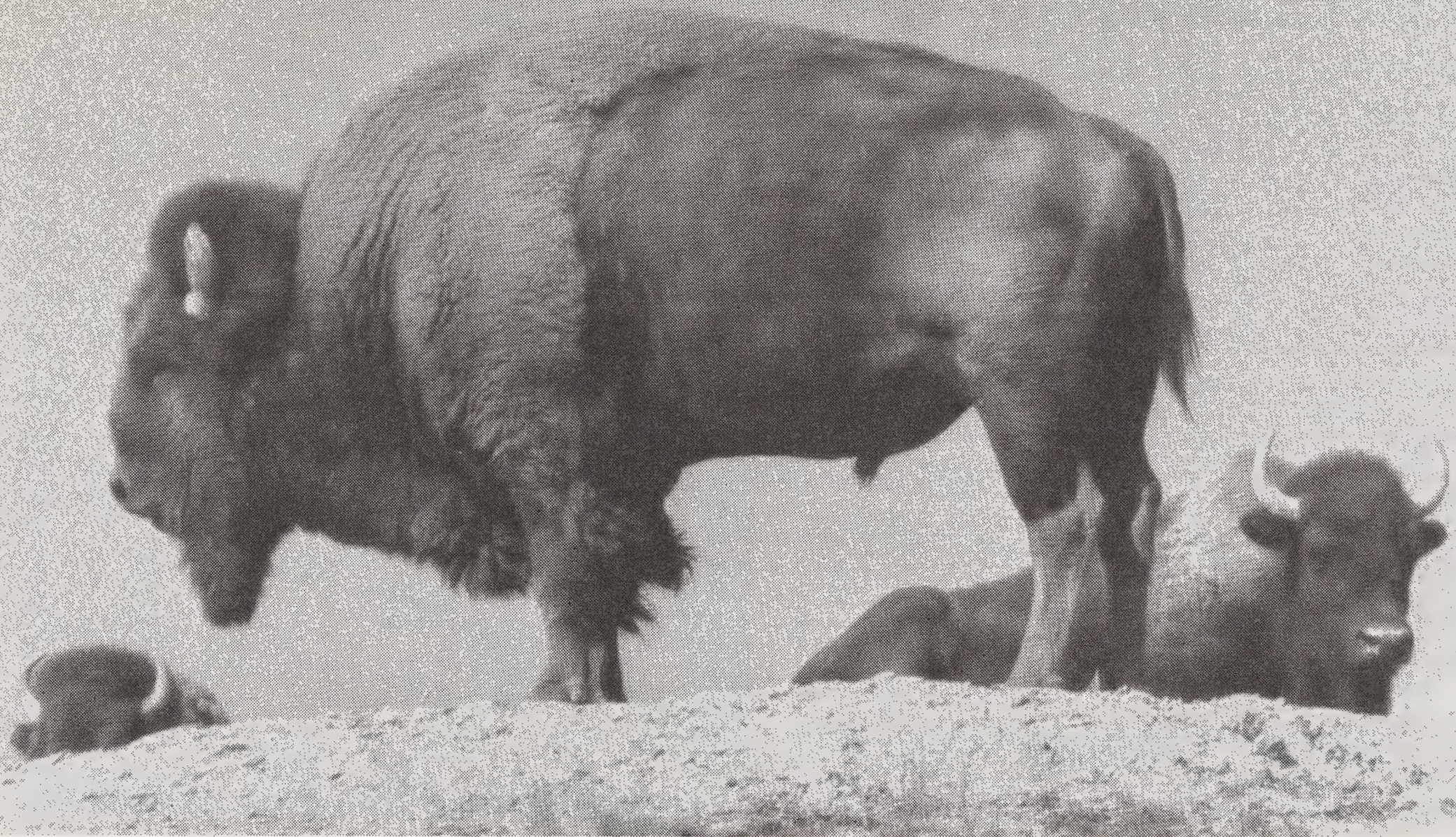
But these social patterns are reserved exclusively for the aging males of the bison herd. The aged females do not behave like their male age-mates. They never leave the social role within the herd.

Is this behavior a general life-phenomenon? Is there a deeper social attachment or a need for security of the group in the female? If so, what role does an aging bison cow play in the herd life?

There are, of course, individual differences in respect to social adaptation among old bison cows, but in general the picture is clear. The old cow moves from the central position in her own family (cow-calf attachment) into an attachment to younger bison cows with calves. She continues her role as leader and watches the safety of the herd, although no longer for her own offspring. Such behavior is quite similar to that recently reported for older giraffe females in South Africa and for old elephant cows, which are known to form a protective partnership with a younger elephant cow before, during and after the birth of the new elephant baby. Such attachments have been aptly called the "auntie" system by British writers. An "auntie" elephant walks, stands, forages and rests in closest contact with the adopted elephant mother and her baby.

In case of an attack or intrusion, the older female will stave off the predator or intruder and shield the group or individuals with which she is connected.

Although not quite as clearly defined as in aging elephants, giraffes and bison, there seems to be a similar trend in aging elk cows (*Cervus*



canadensis) for attachment to other family groups when they do not have a calf of their own. Juveniles (yearlings) are also at times adopted by such aging elk cows and form apparently a substitute for the accustomed herd and family life.

In the stately moose (*Alces alces*), which leads in general a much more solitary type of life, we had difficulties at first in finding clearcut behavior patterns which differentiate the aged members of the species. But observations during stress and commotion of the rutting season in September revealed that a detachment of the aged moose prevails in male and female members of the species. Such detachment may take the form of a complete retreat from active mating areas or it may result in a banding together of "leftover" moose such as other oldsters or with some "driven out" juveniles. These associations are not as durable and well integrated as regular moose groups. The juvenile members seem, at times, to get impatient with the sedate way of life. They indicate their youthful eagerness for action by getting up and making "intention movements" to leave or to change activities, but soon they turn back and take their cues from the old, experienced animal. The old one, despite its slowness and extended periods of rest, gives the small group the needed security in their living space. When to get up and browse, when to rest and when and where to move for better places, for comfortable warmth or less insect-bother, the aged moose can show the

This old Bison bull—note the worn and stubby condition of the horns—is still keeping his position in close association with the herd. As a wanderer, he leaves and rejoins it at will.

Photograph by the author.

young ones the answer. Most of all, it seems that the question of security is handled best by the experience of the old animal. The often delicate decision whether to quietly evade an intruder or to attack and fight is also managed by the older moose in the group. Bears, coyotes and tourists are actually no serious threat to a grown moose, under normal conditions, but the tactics of even a chance encounter are a matter of learning and adaptation within the framework of innate species patterns. Such situations are showing the clear leadership of the aged animal in the complicated evaluation of sensory cues, be they by hearing, by sight or by smell.

Research work in the laboratory on captive, confined animals can hardly provide information on such questions, but the naturalistic method of field observations over long periods will, we feel, furnish more detailed answers.

While we must leave the human application of such findings to scientists of extreme skill and restraint, it is appropriate to remember that any extended knowledge of behavior patterns in the animal kingdom will eventually foster the recognition and management of our human problem, however remote.

A Laboratory Look at a Peculiar Worm

By WILLIAM BRIDGES

Curator of Publications

A COUPLE OF YEARS AGO Dr. Ross F. Nigrelli, the New York Aquarium's pathologist, gave me a short note for publication in *Animal Kingdom*. It had to do with some discoveries he had made about the sex-determining and growth-inhibiting properties of a marine worm from the Bay of Naples, and he suggested that some day, maybe, it would be worth a longer article in the magazine.

Seldom enthusiastic about worms, even from the picturesque Bay of Naples, I gave him a dubious "Well . . . maybe," and added that "Of course, *any* animal is interesting, but . . ."

A few weeks ago Dr. Nigrelli phoned me at the Zoological Park.

"You remember that article we were going to write on *Bonellia viridis* — the marine worm from the Bay of Naples? Well, I have some whole worms now, in alcohol. Want to see them?"

I didn't really, but I was going to be at the Aquarium next day anyway, so I said I'd drop in at his laboratory in the basement. The new worms, however exciting I was supposed to find them, obviously were being taken in stride by the laboratory staff. One technician was lost in a brown study over a flask smoothly rotating in a cylinder of water, two white-coated men were alternating shaking and examining another flask of dark liquid and a girl in a prettily-figured dress was fooling with a microscope and humming quietly. Dr. Nigrelli was pecking at his typewriter in the next-door office.

"Not much to look at, I'll admit," he said when I asked him where his precious worms were. "They're right in front of you, in the vial. It's what they do — what we're finding out about

them — that makes them so very interesting."

I picked up the vial. It was three inches high, an inch in diameter and filled with a bright green liquid and what appeared to be some shriveled green grapes, a few strings and a wad of cloth.

"The stringy things — those are the worms? What's the rest, the stuff that looks like pickled grapes, or green peanuts?"

"They're all one. The grapes are the body of *Bonellia*, and the strings are attached — they're the proboscis of the animal. I'll show you."

He brought a shallow glass dish from the laboratory and with forceps carefully lifted out the cloth plug of the vial. One of the green strings was caught in its folds and lifting the plug brought out a dangling, wrinkled green grape.

Spread out on the glass dish with the arms of the proboscis teased out to form the top stroke of a "T," and the downstroke extended until it joined the slightly elongate body, the "worm" did not seem particularly worm-like, but did have a recognizable unity of organs.

"This proboscis, this long, thread-like, T-shaped organ, is what we're especially interested in," Dr. Nigrelli said.

"These worms, *Bonellia*, live in shallow water in various warm seas; we've been getting them mostly from the Bay of Naples because it's convenient to the Naples Zoological Station. They're quite harmless — don't sting you or anything like that — and they feed on algae, bacteria, other smaller worms. The Station's divers go down about ten feet and pick them off the rocks. I'd say they are only fairly common; we've had about sixty in the past three years.

"At certain times, fertilized eggs are shed into

the sea and develop into free-swimming larvae. They look like tiny gelatine capsules about an eighth of an inch long and they have a band of cilia — tiny whip-like hairs — just about where their belts would be if they wore belts. So they drift and propel themselves off through the water.

"As larvae, they aren't any sex — they're just potentially male or female, depending on chance.



This underwater photograph of a living *Bonellia viridis* was taken in the Bay of Naples and shows the "T" shape of the proboscis.

Photograph from Naples Zoological Station.

If one of them has the luck to come in contact with a female's waving proboscis, it starts becoming a male — takes about a month to make the change.

"If it doesn't make the right connection — and it's a big 'if,' because even the Bay of Naples is mighty large — the larva settles down to the bottom, finds a rock of its own, and starts becoming a female. When she matures, chances are a larva will bump into her proboscis eventually, become a male, enter her body — we don't know exactly how — and then the process starts all over again. When the male enters the female's body he lives there as a parasite, a permanent fertilizing agent.

"Now, that's all very well, and interesting enough in its own way, but what got us worked up over *Bonellia* were the implications of this business.

"When the larvae make contact with the mature *Bonellia*'s proboscis, they stop growing. There's a growth-inhibiting agent of some kind at work here. You're always interested in anything that stops growth — you're bound to think about the run-away growth of cancer cells, for instance.

"Naturally, you can't pick a whole *Bonellia* off the rocks and clap it onto a tissue culture to see if it stops growth — you try to get at the substance in the *Bonellia* that's having that effect. So we removed the probosces from a lot of freshly-picked *Bonellia* and simply ground them up in a mortar-and-pestle with a little sea water to make a brie — a suspension. You put this brie in a centrifuge and whirl it around at ten thousand r.p.m. for three or four minutes, and what you've got is a clear, green, translucent liquid that's kind of iridescent, with reddish glints. It has the same properties as the living proboscis of a *Bonellia* worm, and it has a name — Bonellin.

"Bonellin works in the laboratory the same way the living animal does in the sea. Take a lot of *Bonellia* larvae in a dish of sea water, and by adding Bonellin in varying amounts to it we can create all males, hermaphrodites, or larvae with any given degree of maleness or femaleness.

"We soon found out some things about Bonellin that at first we thought were pretty important, but later found weren't critical; the green pigment in the liquid is sensitive to light. Keep it in violet or blue light and it stays green; expose it to

green, yellow, red or white light and it goes colorless on you.

"However, colorless Bonellin is just as active as the green kind, so we learned that the pigment wasn't what's doing the growth-inhibiting. As a matter of fact, the green probably is just a breakdown product of chlorophyll, and maybe its original source is the algae the worm eats.

"Also we found that Bonellin is stable enough to be extracted in 70 per cent. alcohol, and that's the way we get it most of the time — just a little vial of green-colored alcohol by airmail. Let the alcohol evaporate and you get some greenish crystals in the bottom of the dish. Add water — and you've got active Bonellin again.

"We got to wondering, of course, what effect Bonellin would have on other animals and Pierre Tardent over at the University of Zurich, and George Ruggieri and I here in the Aquarium's laboratory began testing it on sea urchin eggs. They're nice to work with, because they're about a sixteenth of an inch in diameter and quite a lot is known about their development. You know about them, don't you?"

I didn't, but I nodded because I wanted to keep on the subject we started on, but Dr. Nigrelli knew it was a rhetorical question and an equally formal nod of assent on my part.

"Now, the sea urchin: there's an animal with an almost unbelievable power of attracting sperms. Here these sea urchin sperms are, swimming every which way in the sea, and the sea urchin egg puts out a substance — it's called Fertilizin — that can attract a sperm to itself in dilutions of one part in two and a half billion parts of sea water!"

Dr. Nigrelli made some quick calculations.

"That's the equivalent of one drop to about thirty-one thousand gallons of water," he said when he looked up. "You know the big Oceanic Tank here in the Aquarium, where the White Whales live? Well, imagine three drops of water added to that tank, and you can see how potent Fertilizin is.

"But don't let me get started on Fertilizin. Some time back, Pierre and George and I found that when Bonellin was applied to fertilized sea urchin eggs in dilutions of one to fifty thousand, it stopped the eggs from developing. Just like that. You could stop those eggs at any stage you

liked. And what's more, we found that Bonellin would immobilize sea urchin sperm without killing them. Sort of paralyzed them, you might say. We *know* it didn't kill them, because if they were close to a sea urchin egg, without making the normal contact, the egg went on to develop what's called the fertilization membrane around itself, as it always does when fertilization takes place. But then nothing else happened. It wasn't actually fertilized.

"So here we had two effects of Bonellin: one, it immobilizes sea urchin sperm without killing it; and, two, it has a growth-and-development-inhibiting effect on the sea urchin eggs.

"At one point along the line we'd tried boiling Bonellin before testing it and we found something we hadn't expected up to then. Bonellin that had been boiled for ten minutes would no longer immobilize sea urchin sperm — but it would still stop the development of a sea urchin egg at any stage we applied it.

"That means, of course, that there are two effects in the same substance, two factors: one that has a paralyzing effect on sperm, and, the other, that stops growth of cells. In sea urchin eggs, anyway — and that's the first step toward . . . well, who knows what?"

"We've determined that Bonellin isn't an antibiotic; it won't stop the growth of bacteria. We know it isn't a poison — injections don't seem to affect laboratory animals.

"What we're trying to do now is to determine Bonellin's exact chemical structure, for once you know that about a substance, chances are you can modify the structure in various ways to heighten one effect, reduce another. It's a powerful, a very powerful, growth-inhibitor for certain kinds of cells. That we know. How many other kinds of cells? We don't know — yet. You don't find these things out in a day, or a month, or a year. But we're working."

Dr. Nigrelli slid the shriveled green grape and its T-shaped thread back into the vial, plugged it with the wad of stained cloth, and screwed the lid on tight.

"There may not be a real story in Bonellin until we find out a few more things," he said. "But I thought you'd like to see the whole worm before we grind it up and start testing it on something else."

News from the Conservation Foundation



Late President Dedicated Pinchot Institute for Conservation Studies

At 1 p.m. on Tuesday, September 24, the late President Kennedy, arriving by helicopter, landed at Gray Towers, the ancestral home of Gifford Pinchot in Milford, Pennsylvania. The occasion was the dedication of The Pinchot Institute for Conservation Studies. Purchased by our organization from the Pinchot family, the building and the surrounding acres have been deeded to the United States Forest Service which will maintain the property.

A cooperative agreement between the Conservation Foundation and the U. S. Forest Service provides for joint management and direction of the programs at the Institute. The Institute will serve six primary functions:

(1) A national conservation conference center.

- (2) A national center for curriculum studies in conservation.
- (3) A national center for the development of instructional materials in conservation for all subject areas and all levels of education.
- (4) Publications in the different areas of conservation.
- (5) Institutes and workshops for the training of teachers in the methods and materials of conservation, in cooperation with a major university.
- (6) A system of demonstration areas to illustrate to students and visitors different types of habitats and different methods of resource use and management.

Co-directors of the Institute will be Dr. Matthew J. Brennan, Chief of Conservation Education for the Forest Service, and Dr. Paul F. Brandwein, Director of Education for the Conservation Foundation.

Although programs in support of their activities are already in the planning stage, extensive alterations in the main building and new roads leading to the outdoor demonstration areas must be completed before the Institute will be ready for full-scale operations.

The day went off precisely as planned. There were brief speeches by the Governor of Pennsylvania, Secretaries Freeman and Udall, Dr. Gifford Pinchot, Samuel Ordway and finally by President Kennedy. Ed Cliff, Chief of the U. S. Forest Service, introduced the speakers and emphasized one fact very close to us all: namely, that the Institute represented an unusual cooperative public enterprise between the Federal government and a private organization.

The Foundation was represented by Trustees Ernest Brooks, Jack Heinz, David Heyman, Howard Phipps and Laurance S. Rockefeller. From our point of view, a gala occasion was marred only by the fact that our Chairman, Fairfield Osborn, had been grounded in Kenya and was unable to attend.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

Prime Minister Nyerere Thanks Society for Wildlife Aid

Soon after his return from the meetings of the International Union for the Conservation of Nature and Natural Resources in Nairobi, Dr. Fairfield Osborn received a letter of appreciation for the Society's wildlife protection work in Africa. It was from Prime Minister Julius K. Nyerere of Tanganyika and said in part:

"When I was in the Serengeti recently the Director, Mr. John Owen, told me of the very considerable assistance given to the Tanganyika National Parks both by the New York Zoological Society and yourself personally.

"At one time I was myself concerned in the administration of the Tanganyika National Parks as a member of the Board of Trustees and I have been very pleased to see how rapidly they have developed during the past few years. Much of this has been due to help from abroad and I would like to say how much we appreciate this help and how grateful we are to you and to the New York Zoological Society for the important contribution you have made to it. Not only has your support been of great material assistance but, as a practical demonstration of the desire of other countries to participate in the task of conserving our wild life, it has been a great encouragement to us and strengthened us in our belief that this is a task well worth doing."

Among the Society's contributions to wildlife protection in Tanganyika are the work of William Eddy in conservation education among Africans, creation of waterholes, aid in purchasing an airplane to halt poaching and purchase of a crater area for extension of one of the Tanganyika national parks.

Broadbills at Long Last!

The rare and colorful birds known as broadbills have often been offered to us, but none ever arrived. Now they have. Two specimens of the Lesser Green Broadbill, *Calyptromena viridis continentis*, of Tenasserim, Siam and the northern Malaya Peninsula came on October 24. It is surprising that after more than sixty years of exhibiting birds we can acquire not only new species but representatives of whole families we have

never exhibited before, but we are in that position in regard to the broadbills, of the family Eurylaimidae.

First Baby Gerenuk

A female Gerenuk, apparently the first one born in the United States, arrived on September 30 and is doing well. The father was acquired on October 1, 1957, and the mother on June 28, 1961. The baby and its mother appear on the cover of this issue of *Animal Kingdom*.

Antelopes for Breeding Program

As opportunity offers, we are continuing to acquire antelopes from which sizeable herds may be bred. Latest are two pairs of Jackson's Hartebeest (one more female is on order) and three female Impala (with two males on order). This is the first time we have exhibited the Jackson's Hartebeest.

Oldest Zoo Resident Dies

For several years the oldest resident of the Zoological Park has been an Azure Jay, *Cyanocorax caeruleus*, which is found from Brazil to Argentina. Received on October 29, 1925, it died on October 28, 1963, just one day short of 38 years in the collection. Its successor for the title is another bird, a Southern Caracara, *Polyborus plancus*, of southern South America. It came to us on March 3, 1928.

IN BRIEF

Weather Did It. Attendance at the Zoological Park in October was 212,976, compared with 166,685 in the same month last year — a direct result of the warm and fair weather this autumn.

Aquarium Exchanges. Bringing a load of halibut, cod, sturgeon, lumpfish and sea ravens, the Quebec Aquarium's collecting truck arrived

at the New York Aquarium in October. It returned with a good collection of our local marine species, gathered at the Sunrise Fish pound nets.

Wisent Situation Good. Dr. Erna Mohr of Hamburg, who has long kept records on the Wisent, or European Bison, reports that at the present time 650 to 700 animals are known, and that increases of 70 to 90 Wisents can be counted on by births each year.

Bird Walk. In 1900, the Zoological Park's most spectacular exhibit was the Large Flying Cage, 152 feet long, 71 feet wide and 51 feet high — still a display area of impressive dimensions and interest. During the summer and early fall our Construction Department built a diagonal walk through the aviary and for the first time visitors can be among the birds as they fly and are fed. Shy at first, the birds soon learned to come to stream below the bridge for feeding; "Bird Walk" has proved in every way to be a great success.

Rarities from Cordier. Before leaving Africa this fall for a new collecting field in Peru, Charles Cordier made a collecting trip along the Congo-Uganda border and from it we acquired six species new to us. A Semliki Fiery-breasted Bush-shrike is now on exhibit in the Jewel Room, and we also received a very rare Reichenow's Pitta, two Blue-shouldered Robin-chats, two Snowy-headed Robin-chats, a Grant's Blue-billed Seed-cracker and a Rothschild's Seed-cracker. Mr. Cordier, who collected the Congo Peacock for us in 1949 and who is considered the leading bird collector today, has worked in the Congo and East Africa for most of the past ten years.

Course on Fish Diseases. A weekly series of lectures on fish diseases, part of the general curriculum on marine biology in the Graduate School of Arts and Sciences of New York University, is again being given in the laboratory of the Aquarium by Dr. Ross F. Nigrelli. Ten students are registered, including physicians from the Pathology Department of Yale University.

"On Deposit" Animals. What to do with surplus animals is a problem that every Zoological Park occasionally has to face. One solution, which we often employ, is to send the animals on deposit to other zoos, where they are a reservoir from

which we can draw in the future. This fall a young male Llama and a pair each of Formosan and Red Deer were deposited in the Beardsley Park Zoo in Bridgeport. In the Reptile Department, "open exchanges" were an African Rock Python and a Reticulated Python sent to the St. Louis Zoo, a Kufah, or Okinawan pit-viper, to the Houston Zoo and three of our large crocodiles — a Nile, Slender-snouted and Salt-water — to the Pittsburgh Zoo.

Special Services. Within the limits of time and personnel, the Society's Education Department gives special tours of the Zoological Park all through the year. Some of the recent ones were guided tours for problem boys, certain biology classes interested in reptiles, a behind-the-scenes tour for student teachers and a review of Mexican animals for senior Girl Scouts on their way to a convention in Mexico.

Park Improvements. For many years the electrical services in the north end of the Zoological Park have been inadequate to meet the demands placed on them; this condition has now been corrected by new electrical lines and transformers. Work on the new Aquatic Bird House is behind schedule, but Exhibition Specialist Jerry Johnson, working in the basement of the Heads and Horns Museum, is well ahead with fabrication of fiberglass cliffs and graphic displays for the interior of the building. Preliminary plans for the "World of Birds" exhibit have been submitted to the Park Department and the Art Commission for approval.

In "Congressional Record." Dr. Osborn's article, "Another Noah's Ark — for New York," published in the *New York Times Sunday Magazine* on Oct. 27, was reprinted in the "Congressional Record" of Nov. 18 by Representative Henry S. Reuss of Wisconsin, under the heading: "The Extinction of Wild Animals Will Rob Mankind of Priceless Treasures."

PUBLICATIONS OF INTEREST

POISONOUS SNAKES OF THE WORLD. By the Medical Unit of the Office of Naval Intelligence. 168 pp., 8 colored plates, numerous text figures. O.N.I. Study 3-62, Supt. of Documents, Washington 25, D. C. 1963. \$2.00.

A compilation, or better still, a critical summary of the broadly scattered and diverse literature on venomous snakes and the treatment of snakebite is greatly to be

desired. Unfortunately, this one issued by the Department of the Navy is so full of errors of commission and of omission that it fails completely to be the kind of source that would be valuable to "our Naval personnel around the world," or to anyone else. It exemplifies all of the worst features of a naive compilation in a single volume.

Obviously, the compiler (or compilers) was neither a herpetologist nor a systematic zoologist. He does not know what a type species is or what a subspecies is, he cannot evaluate differences between the taxonomic arrangements of the nineteenth century (e.g., Boulenger, 1896) and the present, and he has no real grasp of the important literature on the subject (e.g., Klauber's "Rattlesnakes," 1956, is omitted).

The errors of commission appear almost infinite. They range from a complete misunderstanding of Minton's (1952) recommendations on the use of antivenin (p. 21), the report of grooved (rather than hollow) fangs in elapids (p. 34), and the report of "lateral and dorsal fins" (for lateral and dorsal nostrils?) in hydrophiids (p. 50), through innumerable errors in geographic distribution (Cottonmouths in Massachusetts, absent from Florida, p. 89; *Crotalus durissus* in the southeastern United States, p. 95; Coral snakes in the Lesser Antilles, p. 99; etc.), to such egregious statements as that indicating that the two subspecies of *Boulengerina annulata* have the same geographic range (p. 108).

The worst features of omission can be summed up as "no index and no cross-references." Thus, the discussion of fang punctures is on page 6, the figure (without reference in the text) is on page 30. At best the sectionalized arrangement of the pamphlet would make it difficult to use. For example, information on *Naja nigricollis*, the Spitting Cobra, is found on pages 9, 36, 47, 83, 102, 115, 153, 164, Figure 36, and perhaps elsewhere. This can only be discovered by leafing through the entire book.

Surely the Office of Naval Intelligence could profitably have sought competent professional advice. Had the Navy consulted the American Society of Ichthyologists and Herpetologists or the American Institute of Biological Sciences (which has offices in Washington), it might easily have avoided the present fiasco. The Army's Colonel Hugh Keegan, who is knowledgeable about such matters, could have offered much sound advice before the work was undertaken. By spurning such sources of information the Navy has produced a costly monument to non-professional ineptitude.* — H. G. D.

* Since this review was written, word has been received that the Navy has withdrawn "Poisonous Snakes of the World" from general circulation.

VANISHING WILDLIFE. By Roy Pinney. 193 pp., 56 photos. Dodd, Mead & Company, N. Y., 1963. \$5.00.

We are living in a century of extinction of wild creatures and it is curious that few major books of our period have reflected this irreversible trend of the times. However, a spate of books on vanishing creatures has appeared in the last five years and their value can hardly be overstated. Some of them, such as "Wildlife in America" by Peter Matthiessen, have been superbly and accurately written; "Vanishing Wildlife," by Mr. Pinney, does not have these virtues.

"Vanishing Wildlife" includes a foreword by H. R. H. Prince Bernhard, who is President of the World Wildlife Fund, and certainly no one would impugn Mr.

Pinney's good intentions in writing a book on vanishing wildlife. His general philosophy of some aspects of conservation theory is an accurate résumé of some current thought. Unfortunately, the errors in fact and in implication, which even include the misidentification of important photographs, greatly mar the book's usefulness. A few of the confusions in the text include attributing to captive propagation an important part in the preservation of the Trumpeter Swan (it has thus far played no part), several separate and varying statements concerning the present number (60, 75, 100) of the California Condor (as far as we know the population has been about 60 for the last dozen years) and that 46 Whooping Cranes were recorded wintering on the Aransas Refuge in 1961 (there were 36).

Mr. Pinney is known as a photographer and it was disappointing to find that many of his pictures of rare, and not so rare, animals were taken of mounted specimens at the American Museum of Natural History. Good photographs of live American Beaver, Puma, Rocky Mountain Big Horn, Panda and American Bald Eagle are readily available. The number of typographical errors in the text is in conformity with the errors of fact. — W. G. C.

THE LAND AND PEOPLE OF TANGANYIKA. By Edna Mason Kaula. 160 pp., many photographs. J. B. Lippincott Co., Philadelphia and New York, 1963. \$3.25.

A useful and well-illustrated survey of Tanganyika's history, its people and animals and aspirations, through the first year of independence.

RUNES OF THE NORTH. By Sigurd F. Olson. Drawings by Robert Hines. 256 pp. Alfred A. Knopf, Inc., New York, 1963. \$4.95.

A sensitive evocation of nature — people, animals, the wilderness — in the Canadian and Alaskan northland.

LIFE WITH IONIDES. By Margaret Lane. 180 pp., many photographs in black-and-white and color. The Viking Press, New York, 1963. \$5.00.

During a visit to England, Ionides, a professional snake catcher, invited Miss Lane to visit Africa and see for herself the fascination of his profession. The result is an absorbing account of a man, a way of life and a specialized fauna.

AFRICA'S WILD LIFE—SURVIVAL OR EXTINCTION? By Eric Robins. 224 pp., many photographs. Taplinger Publishing Co., New York. \$5.95.

Mr. Robins is *Time-Life* correspondent in Central Africa and this book is a report on his 30,000-mile tour to see what is happening to wild animals, particularly in Kenya, Tanganyika, Uganda and the Rhodesias. The picture is dark, but there is perhaps hope in "some form of interlocking campaign of salvation."

THE WONDERS OF WILDLIFE. 280 photographs, black-and-white and in color, by 100 photographers. Text by F. A. Roedelberger—Vera I. Groschoff. English version by Mary Phillips and Peter Whitehead. Introduction by Peter Scott. The Viking Press, New York, 1963. \$8.50.

An enormous collection of the best European nature photographs, superbly printed in Switzerland. Dozens of the pictures leave one gasping at their beauty.

ANIMAL ADVENTURES IN LANDS OF ICE AND SNOW. By William Bridges. 92 pp., 106 photographs in color. Whitman Publishing Co., Racine, Wis., 1963. \$1.00.

Most of the strikingly beautiful photographs in this book were made by photographers working on Walt Disney's motion pictures in the Arctic and Antarctic. The text, intended for young people, is by the Zoological Society's Curator of Publications.

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The Society's "Growing Pains"

THE CONSTANT INCREASE in the Society's membership is indeed a happy and welcome fact. Our motto is "the more the better." But every change, even a favorable one, creates a new problem. In this case, it raises the question how to accommodate an ever-larger number of members at our mid-winter meetings.

We reached the explosion point a year ago when the Grand Ballroom at the Waldorf-Astoria was filled to overflowing with "standing room only" for quite a few. To our dismay the advance applications for tickets to this year's meeting considerably exceeded last year's, giving rise to the unpleasant prospect that many who came would actually have to be turned away, or stand in the corridors.

About ten days before the meeting we held a staff conference to take care of final details. Someone in a rather plaintive tone remarked, "Well, the only thing we can do is pray for a blizzard." That did it. The day prior to the meeting a severe blizzard hit the city and although the weather cleared by the day of the meeting, traffic conditions remained disrupted. Even then that "gallant company" — our membership — arrived in force, almost two thousand in number, and there was barely a vacant seat.

Next year we cannot rely on a blizzard — nor do we wish to — and consequently plans are already under way so that, blizzard or no blizzard, there will be room for all. Our motto continues to be, "the more the better."

Fairfield Osborn

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NATURAL HISTORY OF



THE SOUTHERN ELEPHANT SEAL

By JOHN WARHAM

Photographs by the Author



EVERY MORNING during the southern autumn of 1961 I opened the door of my sleeping hut on Macquarie Island in the Antarctic Ocean to find a mound of molting elephant seals barring the way. Haphazardly piled together, they lay like giant sleeping slugs. All were males, 12 to 14 feet long, and they weighed, at a guess, about 1½ tons apiece. Their breathing was deep and irregular and occasionally a heave rippled a blubbery back to end with a stentorian snort and a flapping of the grotesque, fleshy trunk at the end of their snouts. Yet despite their bulk the seals were not much of an obstacle and if I was late for breakfast it was never on their account; their reactions were so slow that by running lightly over them I could get away before the sudden pressure of my boots on their bodies penetrated their consciousness and they reared up in alarm.

It is easy to see that the elephant seal's rounded form is adapted to a life afloat. The thick blubber insulates from the cold and aids flotation and the bigger animals seem quite unaffected by the hurricanes that sweep the seas in the west wind zone. A similar efficiency is lacking when they are on land, where perhaps a quarter of their lives are spent. Here the fore flippers are their sole means of locomotion and on these they drag their heavy bodies about in a succession of violent heaves. Thus it is not surprising that the animals soon tire and between bursts of activity subside to rest awhile, but over short distances both the big bulls and the smaller cows can move in a deceptively sprightly manner on occasion.

Southern Elephant Seals are found around the world in the sub-Antarctic zone and before the sealers destroyed them they had breeding stations in temperate regions too — at the Juan Fernandez Islands off Chile and on King Island, Tasmania, for example. Occasional mobs of molting animals are seen on the shores of Antarctica but elephant

The older "beachmasters" are 14 to 20 feet long and their large and inflatable proboscises are often torn, as here. Their bodies inevitably show the scars of violent fights with younger "challenger" bulls.

seals are mainly sedentary and tend to return to the island and even to the particular beach where they were born. Today the species is recovering from the sealing excesses of the last century and killing continues only at Kerguelen and South Georgia where some sort of scientific control is undertaken. On other sub-Antarctic islands the boilers and try pots used to process the six-inch slabs of blubber are slowly rusting in the salty air, reminders of a rather unsavoury episode in man's exploitation of a natural resource.

Fortunately seals exhibit good powers of recovery and at two breeding stations, Heard and Macquarie Islands, where sealing has been prohibited for the last 45 years, the population appears to have reached its natural level once more. In comparison the allied Northern Elephant Seal of Mexico and California still seems to be in the process of recuperating from a remnant of about 100 animals in 1890 to some 15,000 in 1960.

Extensive biological studies were made on the southern species by Dr. R. M. Laws of the British Antarctic Survey from 1948 to 1951 at South Georgia and Signy Islands and by Australian biologists at Heard and Macquarie Islands since 1949. The latter's findings are summarized in a series of papers recently published by Dr. R. Carrick and his co-workers in Canberra.

As a study animal the elephant seal has its good and its bad points. It is large, approachable and easily counted when on land and, unlike some other seals, it comes ashore to breed. On the other hand it is a slippery creature and difficult to handle — look at the photographs and then imagine trying to weigh one of those two-ton monsters! — and the dangerous nature of the coasts it frequents make observations of its habits at sea extremely difficult.

The Australian studies are of a long term nature. They have leaned heavily on the satisfactory development of a method of marking seal pups with hot irons such as are used for branding cattle. Properly applied, the brands are permanent and harmless and up to 1961, 6,850 pups had been marked in this way. As a result the populations now include many animals of known age, particularly at Macquarie Island. A second valuable technique is based on the fact that dentine (ivory) continues to be deposited on the

inside of the canine teeth throughout life while the rate of deposition varies according to the physiological condition of the animal. Sectioning and staining the canines reveals a series of rings which can be correlated with events in the life history — with successive molts, pregnancies, lactations and so forth. It is rather like studying the history of a tree from its growth rings or that of a chamois from the annual ridges that form on its horns.

Sightings of many hundreds of branded animals over the years reveal that each age/sex category has a different annual cycle and often occupies a preferred habitat while it is ashore. Only certain categories of elephant seal are on land simultaneously. For instance, immatures of both sexes are not present in the breeding season, which runs from August to mid-November and, conversely, the breeders do not usually come ashore during the winter months, whereas an annual haul-out of immatures is a prominent event at this season. Likewise, the different categories molt at different times. So if you were to land at a breeding station in any month of the year you would never find the place completely deserted by seals — a situation for which some shipwrecked sailors of past times have had good reason to be thankful.

At Heard and Macquarie Islands four categories of bull elephant seals can be recognized. First there are the immatures 1 to 6 years old and up to 11 feet long. These haul out in the winter months for varying periods, apparently to rest, and they are particularly plentiful after storms. They do not come ashore during the breeding season but re-appear in December to molt and are the first seals to do so. With increasing age the molting season becomes successively later and the next senior class is that of the "bachelor" bulls. These, 6 to 13 years old and 10-14 feet long, do not haul out in the winter and appear ashore after the breeding season has commenced. They do not fight with the breeding bulls, have quite small proboscides (or "snotters," to use the sealer's term) and tend to go back to sea before breeding has ended. Older and more powerful are the "challengers," 12 to 15 feet long and well able to breed if given the opportunity. Eager to get harems of their own, the challengers are constantly involved in struggles with the dominant

bulls or "beachmasters." These latter are 14-20 feet long, have huge inflatable snotters and are strong enough to hold their own against constant threats from challengers or displaced breeding bulls from other harems. At Macquarie Island no branded bull has yet reached beachmaster status so that, as branding started there 12 years ago, it seems that the beachmasters must be 12 years or older. Indeed, a 14-year-old branded at Campbell Island was still in the challenger class.

Compared to the bulls the cows grow slowly but mature quickly. By their first breeding season they have generally reached their maximum size of 8 feet long. Virgin cows mate at sea and some 4-year-olds have pups, but subsequent matings are on shore in the harems.

The breeding season begins in early August when the beachmasters arrive. Later that month the first pregnant cows haul out and they tend to collect in small groups which are then guarded by the beachmasters and harem formation begins. Both bulls and cows are very fat when they first appear and both fast during their stay ashore, the bulls for about 14 weeks, the cows for about 4 weeks. Naturally both lose a good deal of weight, the bulls as a result of the constant strain of mating and of fighting with rivals, the cows

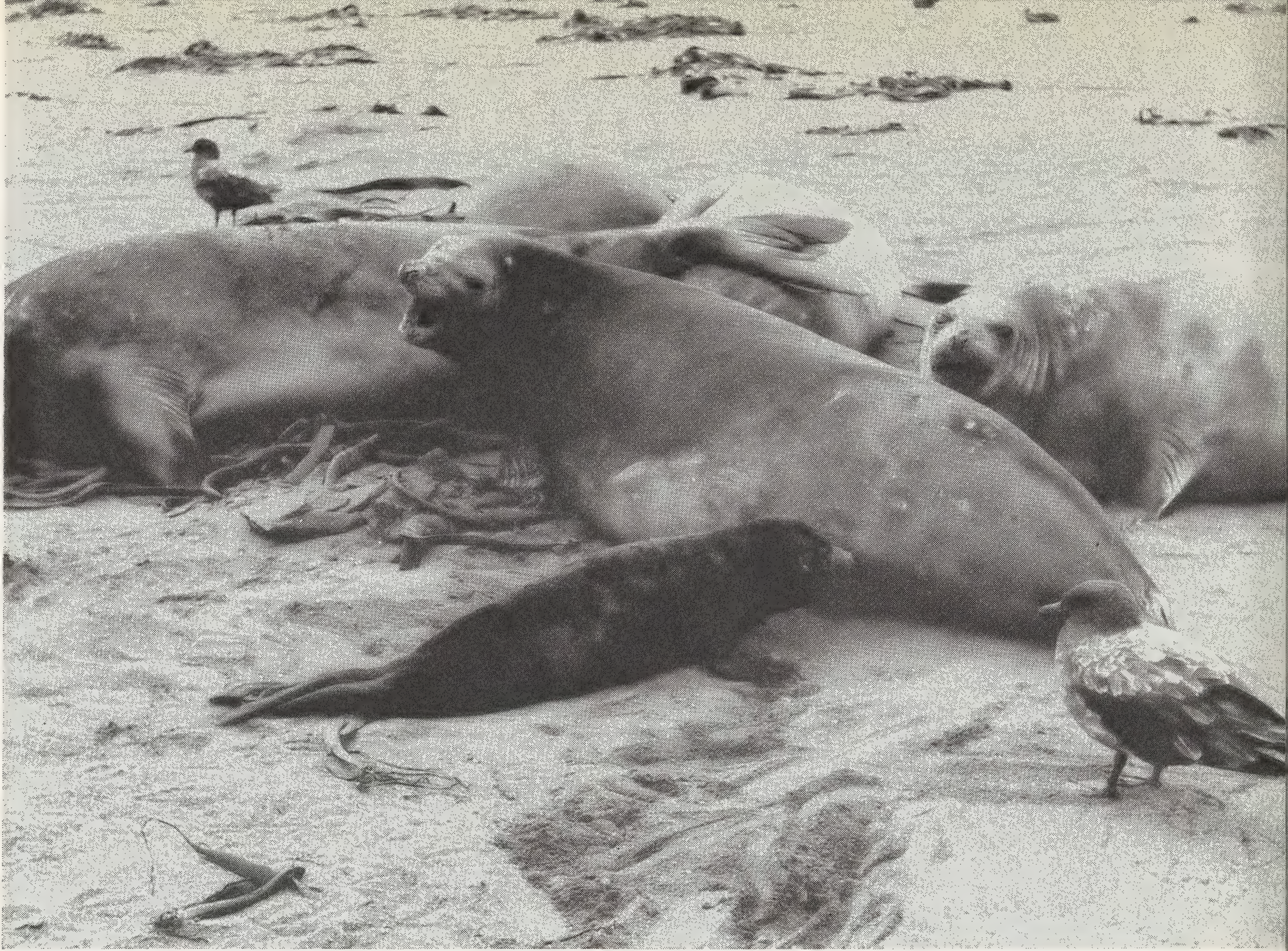
through pupping and the transfer of about 200 pounds of their own reserves to their offspring.

The single pup is born about five days after the mother comes out from the sea and the peak period for births is from September 27 to October 18, cows that produce pups outside this period mostly being the younger animals. For a few days before parturition the cows are irritable, so that instead of lying close to or even on top of one another, they tend to separate and the harems spread out. A typical birth takes some 22 minutes and head and tail presentations seem to be about equally common. The baby has a high-pitched dog-like bark and wears curly black fur. When she hears her pup for the first time the mother barks in reply and turns to nuzzle it and thereafter most cows recognize their own pups and will move over to them should they stray away. Many pups do die, however, through getting separated from their mothers or because of premature return to sea.

The scavenging skuas act as midwives at pup-

Contests between adult males start in August when the "beachmasters" return to the beaches to await arrival of the cows. They use their canine teeth in striking hard downward blows.





ping time and an imminent birth is often indicated by a swirl of loud-voiced brown birds milling overhead. The skuas quickly dispose of the foetal membranes and placenta and of any dead pups. They also help themselves to milk spilt at feeding time, picking the thick creamy fluid from the bellies of the mothers as they lie in slug-like indifference.

At birth the pup weighs about 83 pounds and is 50 inches long. Pups whose initial weight is less than 65 pounds usually die. The rest put on weight rapidly and soon start to molt the natal fur, which is replaced by a beautiful, fine silvery pelage. In three weeks they are weaned, have a three inch layer of blubber on their bodies and look delightfully contented. They now shuffle inland away from the harems and rest while their muscles develop further. Then, at about five weeks old and mostly on calm evenings, they make excursions into the water. Some swim in freshwater lagoons behind the beaches and, gradually gaining confidence, they start to go to sea by day until, at the age of about nine weeks, they depart.

Soon after their pups are weaned the cows

The pups are weaned at the age of three weeks and by that time have a three-inch layer of blubber on their bodies. Skuas keep a close watch at pupping time, often pulling at and feeding on the placenta.

mate with the beachmasters and after a few days they return to sea to recuperate from the strain of breeding and to fatten up in readiness for the molt. As with other seals, the development of the embryo is delayed and in the elephant seal does not start until after February when the cows have completed their molts.

The size of the harems varies greatly. On small isolated beaches the harems are often small, whereas on open beaches, easily approached from the sea, they may be huge. One at Macquarie Island, which regularly contains over 1,000 animals, develops from a nucleus of just a few cows. Dominant beachmasters appear to remain with the same harem throughout the season but less powerful bulls may be forced to retire in favor of others, while in large harems assistant beachmasters dominate sections of the herd. Few beachmasters can look after more than 50 cows and the 1,000-cow harem mentioned above holds about



30 bulls at the height of the breeding season.

Where there is a lot of fighting between bulls, the cows are inevitably subjected to a good deal of disturbance and this makes them try to move out to quieter harems. Because of such movements the cows often do not have their pups in exactly the same harem each year though this does happen. MA 102, for example, pupped in the same place near the Australian camp for four successive seasons before shifting about half a mile for the fifth.

There is a good deal of variation in aggressiveness. The largest bulls are not always the most vicious and many will not attack a man unless he gets right among the cows. The latter are perhaps more dangerous than the bulls and have inflicted some nasty bites on careless investigators in the past, though more usually the damage has been restricted to the removal of the seats of their pants! I recall very well one old bull with a vile temper who always left his charges and constantly tried to reach me whenever I had to pass through his section of the beach. He would let out a mighty bellow and come lolloping downhill at quite a speed, scattering cobbles as big as dinner

These weaned pups have moved out of the harem where they were born and are resting before setting out to learn how to fend for themselves. They have molted the black natal coat and are silvery.

plates with his thrusting flippers. Often I had to break into a run to dodge him.

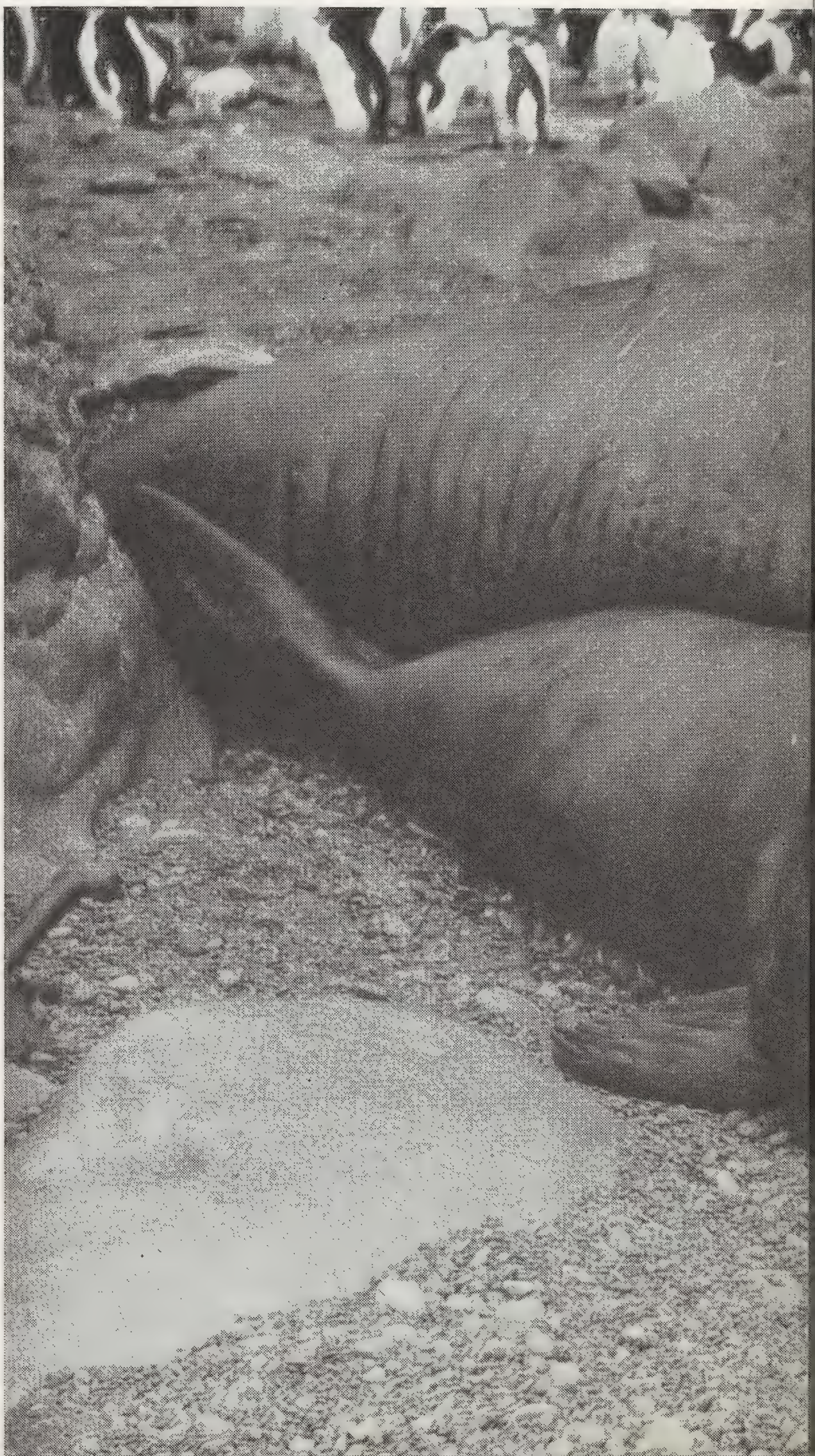
Challengers can cause nasty upheavals in the harems, for the beachmasters may charge straight towards the newcomer, flattening any cows and pups that lie in their way. New-born pups get killed at these times and the beachmasters are singularly insensitive creatures and often come to a halt or even fall asleep while a pup, pinned helpless beneath the two-ton bull, barks pitifully and struggles in vain to free itself. Larger pups and the cows seem to be protected by their blubber and while they may get rolled over onto their backs they soon manage to right themselves with a lot of grub-like wriggling and indignant barks.

Most contests between bulls are settled without fighting. A single roar, a rasping and prolonged belching sound with the ejection of a small cloud of spray, serves to send a bachelor hurrying for the water's edge. Challengers are more serious



rivals which often exchange roars with the beachmaster and inflate their snotters. Many weaker animals retire at this stage but others come closer and the two rear up so that each towers perhaps 12 feet in the air with two-thirds of their bodies off the ground. Again, many animals retreat at this juncture, snorting loudly, deflating their proboscides and backing hurriedly away, but some fights do develop in which each contestant, with fast and violent slicing movements of his head, tries to thrust his tusks into the head and proboscis of the other. The heads, noses and shoulders of older bulls are always profusely scarred as a result of such fights but popular accounts of gory battles between these monsters are much exaggerated. In 15 months among elephant seals I saw only one fight in which the defeated animal could possibly have suffered permanent damage. Casual observers overlook the fact that these seals are richly supplied with blood, bleed profusely and can get quite badly bitten without being permanently harmed.

When the last inseminated cows have returned to sea the beachmasters themselves also depart. The cows are back again for the February molt but the bulls come back later and the old and successful beachmasters do not usually turn up until April. Evidently the degree of exertion in-



involved in breeding and their long fasts requires a correspondingly long period of recuperation at sea.

The molt in elephant seals is unusual in that the hairs are not shed gradually as they are with a dog, for example, but the epidermis with its attached hairs peels off in patches starting with the region around the nose and eyes. The process is hastened by vigorous scratching with the flippers. Molting seals are sociable but the sexes do not intermingle at this time. Cows and bulls

have their own traditional molting places, often on the mossy "featherbed" behind the beaches where the restless animals soon break through the surface and churn the whole area into a vast mud bath. In this gooey mass they lie perhaps with only a nostril exposed and the resulting stench is not for sensitive stomachs. The seals appear to suffer a good deal of irritation during their molt and wallowing may perhaps relieve the itching.

Although the molting dates of the cows vary, with the older ones molting later, there is no corresponding variation in the pupping dates. The breeding cycle seems nicely adjusted to produce weaned pups at the time most favorable for their survival. When they depart, the density of the surface plankton is at its peak and for a couple of months at least there is an abundance of food, providing that the pups can learn how to catch it.

Nevertheless survival data from branded pups show that 50% of either sex die in their first year. Losses subsequently are much less and

A newly-branded pup. M indicates Macquarie Island, P that the pup was born and branded in 1961 and HM designates this particular pup. The harmless brands are made on the skin.

Copulation takes place about the time of weaning and this picture emphasizes the great difference in size between the sexes. Cows generally reach 8 ft. by the first breeding season.





40% live to their fourth year. These results suggest to the Australian workers that if elephant seals *have* to be harvested for their blubber, then it may be better practice to take the fat weaned pups rather than adult males above a statutory length as is done at South Georgia. Taking the weaners would also involve much less disturbance among the cows. Such a system would parallel that used in harvesting "mutton-birds" in Tasmania and New Zealand where the fat squabs only are taken. As most of these are destined to perish at sea in their first year of life, it is not surprising that the current scale of cropping seems to have caused no diminution in numbers of the birds over the years.

Another point made is that the old experienced beachmasters make a better job of managing the harems than do the younger bulls and therefore the older bulls should not be culled at all. Elimination of this class at South Georgia has allowed males as young as seven years old to get harems, and at that place cows may become pregnant when only two years old. This precocity could arise if the South Georgia animals have not yet reached their optimum numbers so

This molting Elephant Seal, a young animal, has blundered into a penguin colony where the birds hold their ground and peck hard at him. Usually some adults and chicks are overrun.

that the local food supply is not fully exploited, and a similar situation may hold good in California where virgin cows and even some one-year-old Northern Elephant Seals come ashore during the breeding season. In contrast, at Macquarie Island, the food supply seems to be fully exploited and so lower-caste animals are probably unable to feed around the island during the breeding season, let alone come ashore to face the increased bickering between cows and the constant fighting of the bulls.

Finally it is worth noting that while we now know a good deal of the elephant seal's life ashore we know next to nothing of its doings at sea where it spends the greater part of its life. Presumably the adults disperse widely during the winter months, but naturally enough very few people have ever seen them at sea for at that season these stormy waters are almost deserted by ships and by man.

Woodpecker Finch
of the Galapagos —

THE BIRD THAT USES A TOOL FOR FOOD-GATHERING

By IRENAUS EIBL-EIBESFELDT

Max-Planck Institute

Photographs by the Author

Among ornithologists, few birds are as celebrated as the finches of the Galapagos, often called Darwin's Finches because of their impact on Charles Darwin's evolutionary theories. And among the approximately thirty species and subspecies of finches in the islands, the most celebrated is certainly the Woodpecker Finch, for it is the only bird known to make use of a tool for food-gathering.

In the course of three visits to the Galapagos, Dr. Irenaus Eibl-Eibesfeldt of the Max-Planck Institute in Germany made a particular study of the Woodpecker Finch, *Cactospiza pallida*, and photographed its employment of a cactus spine to extract its insect food from holes too deep for its bill to probe.

Subsequently Dr. Eibl-Eibesfeldt wrote an account of the finches from which the following paragraphs are extracted, as translated by John Burchard. — Editor.

AS THE NAME INDICATES, the Woodpecker Finch occupies the ecological niche of the woodpeckers, which never reached the Galapagos. It tears the bark off trees, pries open insect burrows with its bill and searches for their larvae. Often it listens with its head



A Woodpecker Finch inspects the boring hole of an insect larva.



The finch inserts the tool and probes.



The larva is levered up.



And then comes the reward — eating the larva.

pressed close to the bark — an extraordinary sight — to hear whether anything is moving under the bark. When one of our ordinary woodpeckers has located an insect, he extracts it from its refuge by using his long tongue. Since the Woodpecker Finch lacks such a specialized tongue, he achieves the same objective by a most remarkable method. As soon as he has opened an insect hole, he flies to the nearest cactus and brings back a longish spine. This he holds lengthwise in his beak and with it pokes the insect out of its hole. Active insects run out of their holes and are caught at the entrance. (As boys, we used to tease crickets out of their holes with a straw; the method is the same). Slow-moving larvae are extracted with prying movements of the spine, or sometimes the finch even harpoons them and pulls them out. Then he puts one foot on his tool to hold it down, and pulls off the morsel. I also occasionally saw him prying up pieces of bark with the spine.

The way the Woodpecker Finch handles his tool looks distinctly intelligent. The impression is strengthened by the fact that he plays with it when no longer hungry. For a long time I had a tame male, who used regularly to hide his mealworms after he had eaten enough, and then fish

them out again with his little stick, only to hide them anew.

Such behavior is quite unusual in a bird; it is familiar only among the highest mammals — for example, a dog who carries his ball up a slope and then lets it roll down from the top in order to chase and catch it again.

To what extent tool-using is innate in the Woodpecker Finch must be tested by rearing animals in isolation. At the time of writing I have a pair which are already courting busily. If we succeed in breeding them I will be able to report on such experiments. I had one young male that did not know how to use the stick. He was interested in the tool but dropped it after lifting. After some weeks he started to probe, but not when he discovered some insect in a crack. Then he dropped the stick and tried to get at the prey with his beak. For his playful probing he used a great variety of objects, even soft stems and leaves. Some weeks later he used the tool in the appropriate way. This indicates that learning plays an important role in the development of the technique, the interest in handling and probing with sticks being the innate base for the learning.

Our First CALABAR PYTHON

By HERNDON G. DOWLING

Curator of Reptiles

“PYTHON” is a word that evokes certain pictures in the mind: a thick-bodied, malevolent snake at least twenty feet long, hanging from a limb above a game trail . . . waiting, just waiting, for a Bushbuck or a hunter to come stepping unwarily down the trail.

Unfortunately for the popular concept, pythons of these dimensions are far from typical of their group. Only three species of the score or so kinds ever attain a length of 20 feet, and these only rarely. Most pythons are in the five-to-ten-foot-long range, and some are even considerably smaller.

One of the rare and diminutive kinds has just come to us as a gift from Mrs. Dora Weyer, a member of the Zoological Society who has been living in Harbel, Liberia. It is a two-foot-long Calabar Python, *Calabaria reinhardtii*, and it arrived in a small can along with some other reptiles. It was the first of its species any of us in the Reptile Department had ever seen and the first recorded for the Zoological Park.

Its body is plump and cylindrical and the blunt tail-tip is actually wider than the pointed head. Because of its small and inconspicuous eyes and the absence of a distinctive neck, the head is practically indistinguishable from the body. Its scales are smooth and glossy and most of them are warm reddish-brown. Scattered irregularly through these darker scales are lighter ones, almost cream-colored, that give the snake a distinctive speckled appearance.

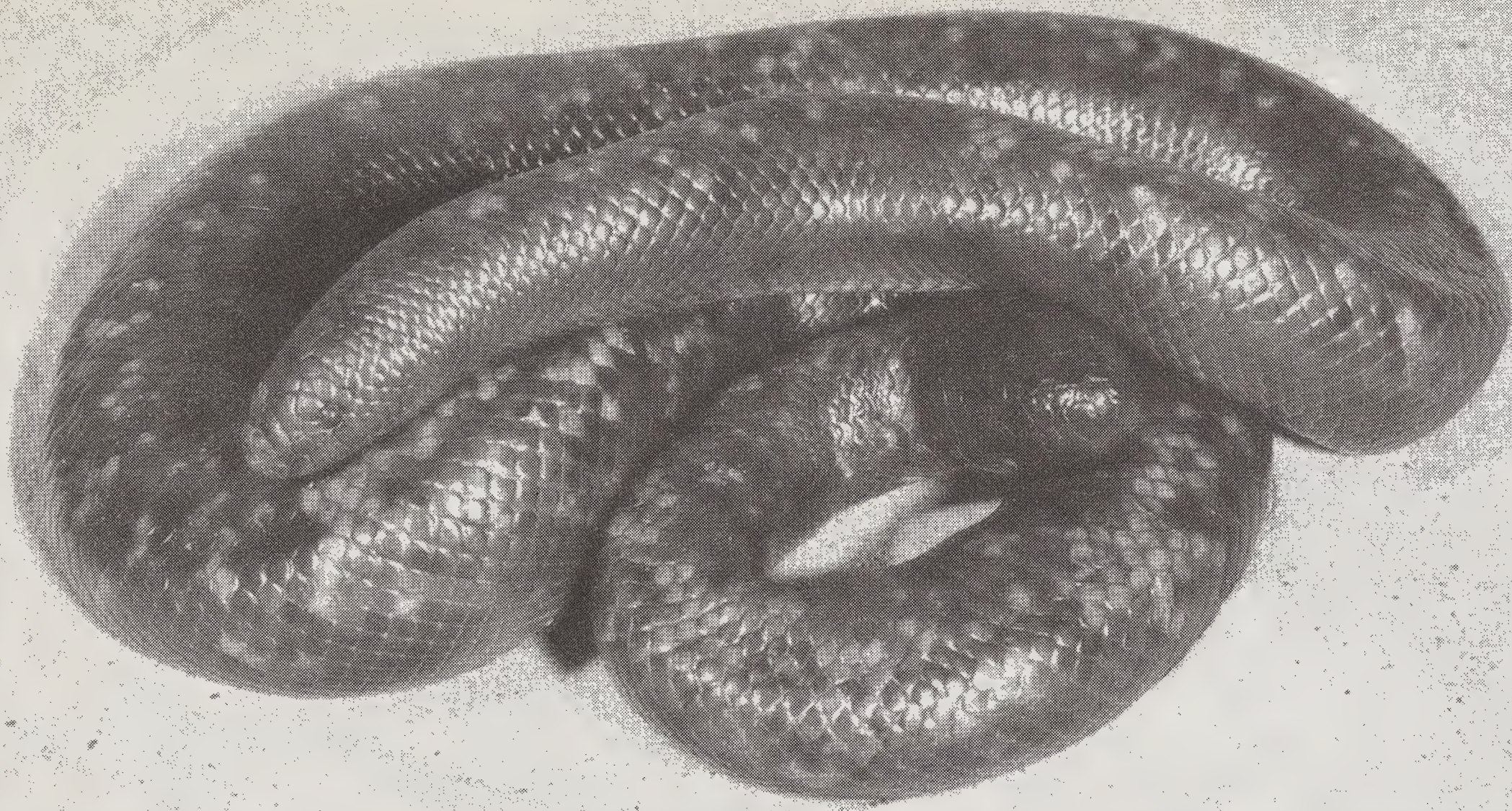
This small burrowing relative of the giant snakes is little known, even in its own native West Africa. The local people have no special name for it; they merely refer to it by the name they use for other burrowing blind snakes of the

region, “nitiniforo,” which literally means “a snake without head or tail.”

Soon after its arrival, we had a chance to see why there is confusion about which end is head and which is tail. Pushing its undistinguished head end under the loose coils of its body, it raised its broad and stubby *tail* in a cobra-like threatening gesture! Other burrowing snakes, including the burrowing boa, *Eryx*, have this same habit, and it forces one to wonder whether the possession of a stubby tail leads to such habits, or vice-versa.

The one thing typical of little-known reptiles is the paucity of literature on them. That on the Calabar Python is scant, repetitious, conflicting and generally unhelpful. But it does indicate that most specimens have refused to eat in captivity. The single reported instance of feeding was that of a snake that “would swallow large worms after the end had been placed inside the mouth.” There are many creatures called worms. What kind of worms were meant here? In any event, they seemed a most unlikely natural diet for a python. Mrs. Weyer was more helpful than the books. She assured us that our snake had eaten small rats, which at least seemed reasonable and in keeping with its pythonid relationships.

Even when we speak of “pythonid relationships,” however, we are on extremely insecure ground. For many years the pythons occupied one family (Pythonidae) and the related boas another (Boidae). More recently the close relationships of these two groups, which together include some sixty snakes, have been recognized by placing both in a single family, the Boidae, retaining the pythons in one subfamily, the Pythoninae, and the boas in another, the Boinae.



The Calabar Python we have just received from Liberia certainly does not match the popular concept of a python, for it is only two feet long. Tail-tip is wider than the pointed head. The snake is little known, even at home.

At the same time, it has been discovered that these are not such close-knit and uniform groups as the names might suggest, but rather that each subfamily includes a highly diverse group of snakes with often overlapping characteristics and also some strange members whose characteristics are neither those of "typical" boas nor "typical" pythons. Taxonomists being what they are, this situation has led to the recognition of still other subfamilies. But not necessarily to a better understanding of the interrelationships of the group.

Links among the burrowing members are particularly obscure. Of the pythons in Africa, one (the African Rock Python) is a giant, two (the Ball Python, *Python regius*, and its relative in southwestern Africa, *Python anchietae*) are moderate-sized and terrestrial, and only the Calabar Python is a burrower. In the desert areas of Africa and Asia live some burrowing boas (*Eryx*), but the closest burrowing pythons, as they are now recognized, are in the Australian region and Central America. Such a widely dispersed distribution indicates either that this is a very ancient group that has had many eons to attain its present extent, or that these snakes are not closely related at all — that they resemble one another

merely because of their burrowing adaptations that have been added to the characteristics of their primitive structure.

So far, any idea of relationships is purely a matter of speculation, for no one has been able to sort out relationship characters from those that simply indicate a common adaptation to a burrowing existence. The conical head, small eye and polished scales are all obvious burrowing adaptations, but what about the others?

One burrowing python-like snake that occurs in Asia is the picturesquely-named Sunbeam Snake (*Xenopeltis unicolor*), so named for its highly polished and iridescent scales. At present it is placed outside the Boidae in another family. Some have suggested that the American Burrowing Python (*Loxocemus bicolor*) may be more closely related to the Sunbeam Snake than to the pythons; a similar case could probably be made out for the Calabar Python.

The upshot of all this discussion is that we do not know much about the Calabar Python. We do not know who its close relatives are — if any. We do not know whether it normally eats worms, or rats, although we rather suspect it is the latter. And we do not know, yet, whether it will thrive under our conditions. Nevertheless, we are glad to have the opportunity of becoming better acquainted with it; we can hope that knowledge of burrowing pythons in general and of the Calabar Python in particular will be increased by this unexpected and unusual gift.

ZOO NEWS IN PICTURES

Photographs by SAM DUNTON

Staff Photographer



“Sturdy and independent” are terms to describe the male Okapi born on November 24, the third offspring of “Bilota” and “Muyoni.” Their first calf, born in 1959, is still in the collection, and it also is a male; the second calf, produced in 1962, lived only 2 weeks.

Our male Reindeer, which came to us in February, 1957, and is now about 8 years old, had an excellent rack of antlers this year; they were probably at or close to their peak. The left antler measured 3 feet 9 inches on a straight line, the right one 3 feet 4 inches. Both dropped on the same day, December 17.



The last baby to be born in 1963 was a Kinkajou, which arrived in the Red Light Room at the Small Mammal House on New Year's Eve. Kinkajous are not rare in captivity, but births are — this is only the second one born here.



In preparation for the establishment of the new Wildlife Survival Center in the Zoological Park in the spring, we have received two male and two female Jackson's Hartbeests. One pair is currently being exhibited in the Antelope House.

A ZOO-MAN'S TOUR OF EUROPE: II

By WILLIAM G. CONWAY
Director, Zoological Park

In the November-December issue of ANIMAL KINGDOM, Director Conway commented on his visit to the zoological gardens of Amsterdam, Rotterdam, Wassenaar, the Jardin des Plantes and Vincennes in Paris, and Clères in Normandy. This article concludes the account of his trip. — Ed.

IN SWITZERLAND I visited two famous zoos at Zurich and Basle. Neither is large and Zurich, opened in 1929, covers not more than twenty acres. Its present director, our friend Dr. Hediger, met me at the airport early on the morning of August 28 and we kept up a non-stop zoo-talkathon till evening when he put me on a train for the Basle Zoo. Zurich is in the midst of a vigorous building program and Dr. Hediger is a renowned animal behaviorist. Thus it seemed natural for our conversation to range from automatic ape feeders and open-fronted bird displays to pigeon-eating duikers (a small type of antelope) and senescence in chimpanzees. And in course of all this we stopped to admire an Asiatic Elephant reputed to be nearly 54 years old, to watch a breeding family of flying foxes, to examine the widow of a huge and dangerous Orangutan which had escaped in another zoo and been shot, and to consider a glass partition between



Gibbon families which hadn't worked. (It had to be painted, as the animals were overexcited by each other.)

The Basle Zoo, opened in 1874, has won a world-wide reputation for its success in breeding rare animals. A partial list of its recent successes include the Indian Rhinoceros, Lowland Gorilla, Pygmy Hippopotamus, the Waldrapp, the Tasmanian Swamp Hen and the Chilean Flamingo. Here, naturally, I devoted my attention to the technical details of diet and also handling, for I have seen no zoo where closer relationships exist between animal and keeper. While I was interested to find that the Basle Zoo raises some of its own animal feeds and that yogurt is good for Malayan Tapirs with diarrhea, I was astounded to see a young keeper walk boldly into the cage of an adult pair of Orangs and their new baby, sit down with a pan of food and participate in their lunch. Later my admiration grew as I watched two young-adult *bull* African Forest Elephants docilely carrying school children about the zoo. The five African Forest Elephants seem likely to provide Basle's next breeding success.

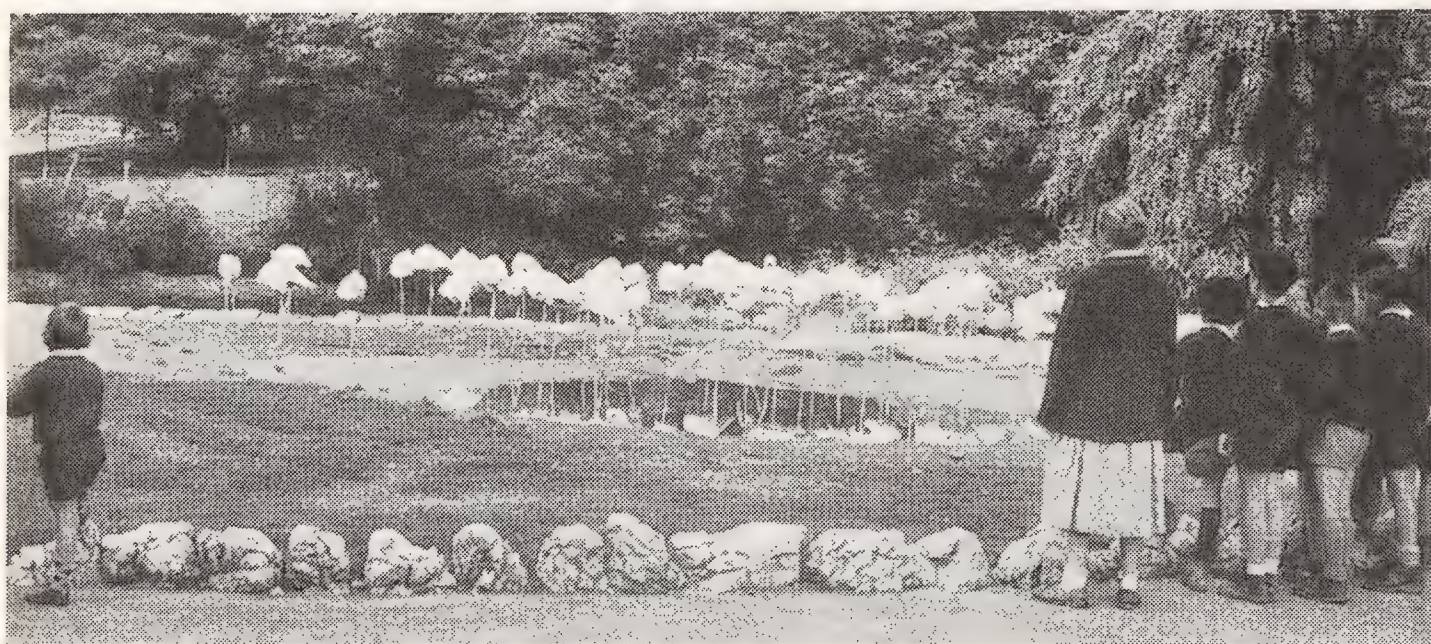
If consistent repeated breeding success marks successful animal management, then Tierpark Hellabrunn, the zoo in Munich, is outstanding.



BASLE

Basle Zoo is celebrated for its success in breeding rare animals and its rhino family is one of the most valuable of such groups.

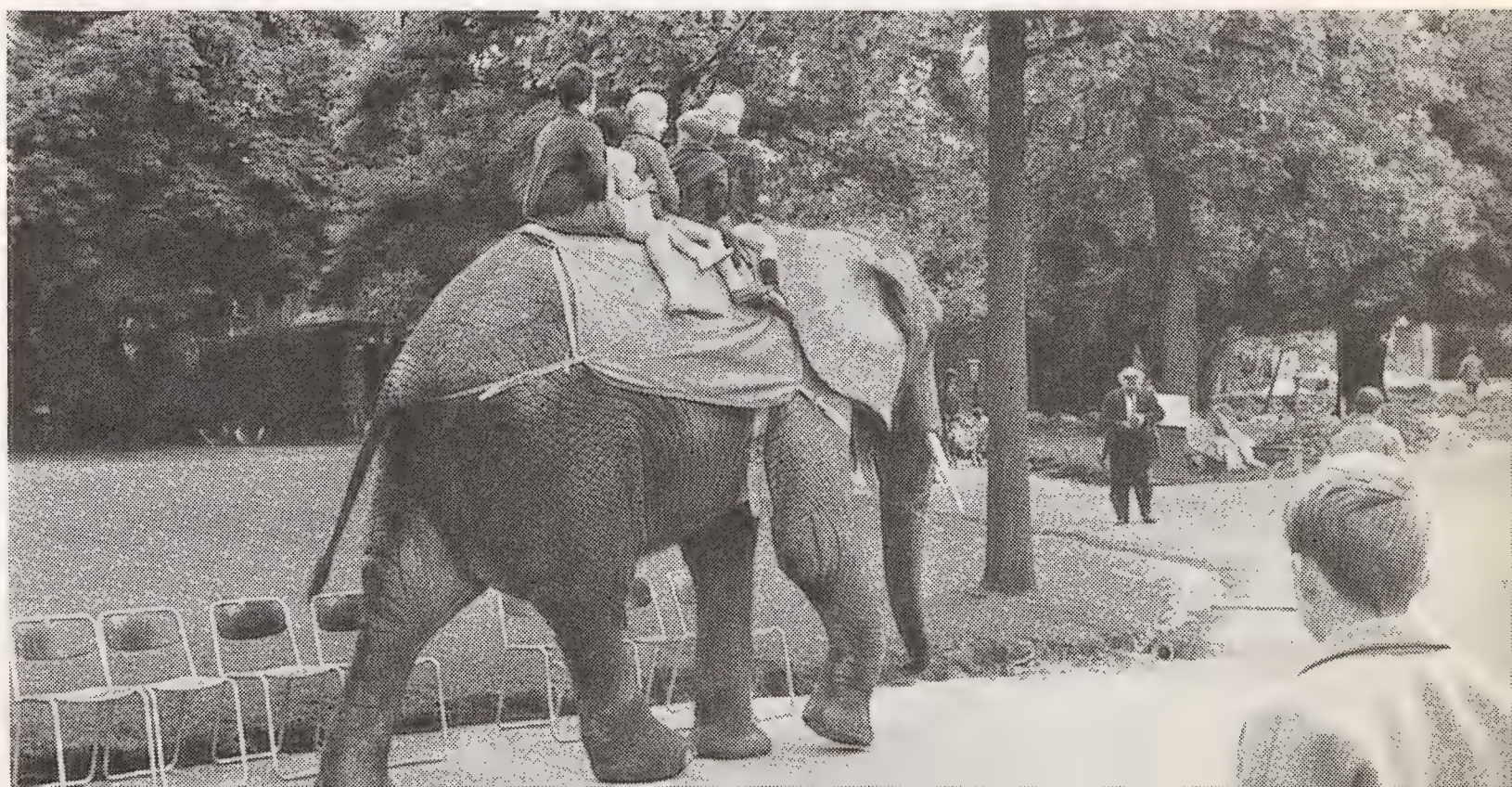
Last year four pairs of White Storks were induced to nest on artificial nest platforms built on this lovely forest hillside.



Visitors stand respectfully behind a line of low stones to admire Basle's flamingos — as they should, for a breeding flock of flamingos in Switzerland is an achievement demanding respect.

Seeing is believing: plodding along, an adult bull African Forest Elephant, one of five in the collection, carries children around the zoo daily.

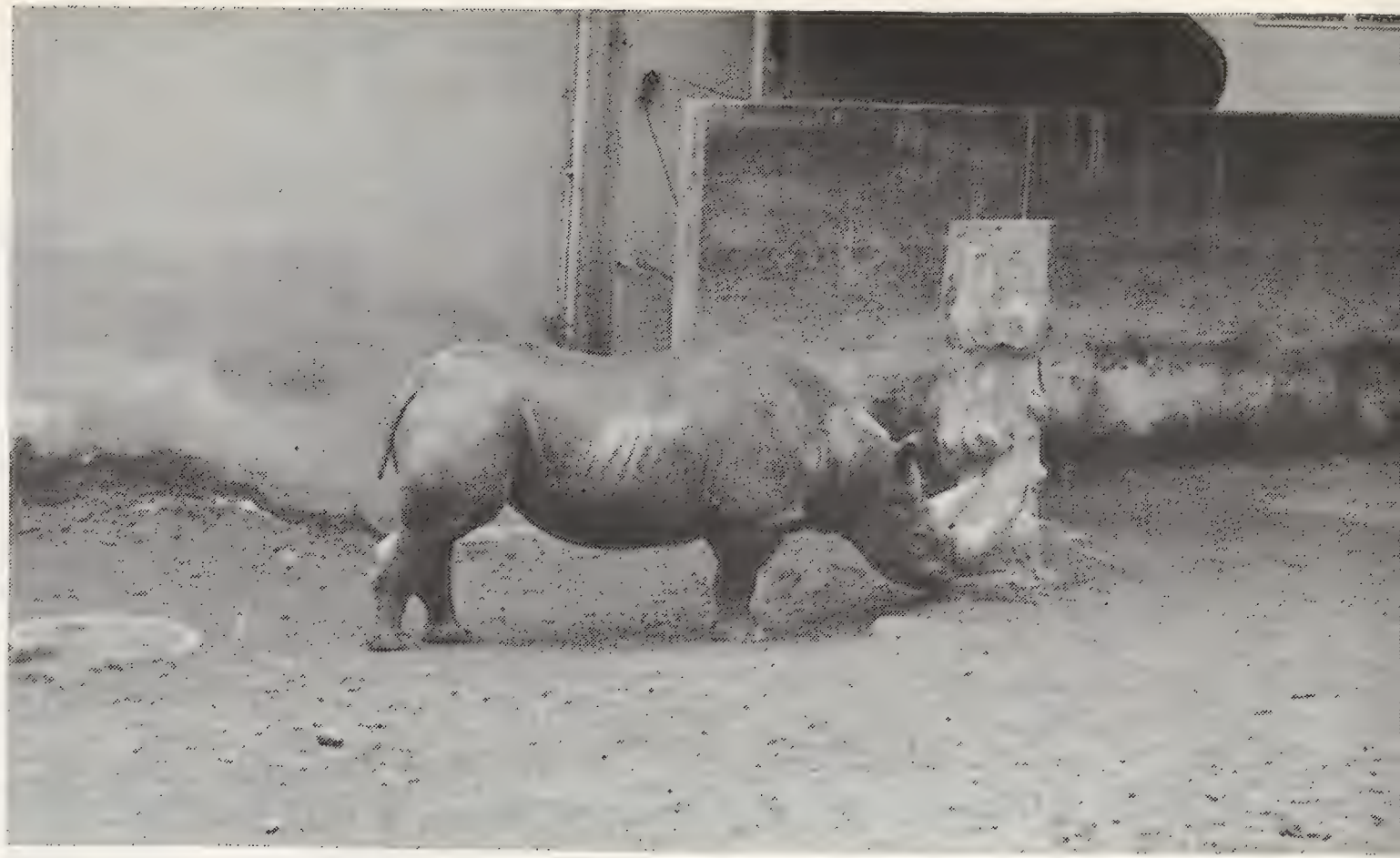
FEBRUARY 1964



ZURICH

A Black Rhino dresses his horn in Zurich Zoo. When the log becomes worn, Director Hediger allows children to pull off frayed splinters as treasured souvenirs.

Zurich Zoo is busily building — a huge sign announces construction of a new house for rhinoceroses and hippopotamuses. It will have big outdoor enclosures.



If I were writing a "Guide to Europe on a Zoo a Day," I would recommend Hellabrün for breeding Ibex, Chamois, Roe Deer, Water Buffalo, and most importantly, the Wisent and Prjevalsky's Horse. To my eye, Munich's broad enclosures are among the finest zoo exhibits to be found. They look as if they have been there forever and it is hard to believe that the zoo was opened only 35 years ago. Hellabrün was the first zoo to be organized, in a major way, on a geographic basis, and its size, more than 180 acres, lends itself to huge exhibits entitled African Veldt, South American Pampas, North American Prairie, etc.

Munich's bird and reptile collections are not extensive for, like Vincennes, it concentrates on mammals, especially hoofed mammals. And most of the fine breeding herds are confined behind shallow, crystal-clear water moats. It is a grand surprise to look over the moat past a Sandhill Crane and a flock of Canada Geese at a fine herd of Bison and then to realize, with a start, that the moat is filled with flashing rainbow trout! The credit for the success of this zoo rests with its venerable Director, our long-time friend, Dr. Heinz Heck, who has operated Hellabrün from its inception.

Dr. Heck, over a period of nearly forty years, has devoted much effort to two highly interesting and highly controversial animal breeding experiments. Using various breeds of domestic cattle and of domestic horses, he has sought to produce an animal similar in appearance to the Aurochs and Tarpan, the extinct progenitors, respectively, of most modern domestic cattle and all domestic horses. Aurochs and Tarpan both appear in the cave painting of prehistoric European man. Indeed, the Aurochs survived into the Middle Ages and the Tarpan was apparently still extant in the 19th century. Graphic family-tree-type signs at Hellabrunn explain the painfully slow series of crosses gradually accomplished to produce the big dark cattle in the "Aurochs" exhibit and one must also look with admiration at the curiously primitive-appearing little "Tarpans." To be sure, these cattle are not Aurochs and these horses are not Tarpans, but they do represent a most fascinating and educated guess at the appearance of these extinct animals. And they call to our attention the ever present danger of extinction to other wild creatures.

Among those fighting to prevent the extinction of wild creatures, no one man in the zoo field today has done more than the Director of the Frankfurt Zoo, Dr. Bernhard Grzimek (who received our Society's Gold Medal on January 10, 1963). And it was to Frankfurt that I now turned with notebook and camera.

No zoo has greater wealth of spacious exhibits than Munich. In this huge enclosure are zebras and antelopes, cranes, flamingos, waterfowl.

MUNICH



Years of careful selective breeding have produced in Munich Zoo a strain of domestic cattle with a resemblance to the extinct Aurochs.



Munich Zoo has also had great success with its breeding program, particularly delicate hoofed animals. This herd of Chamois is an example.



FRANKFURT



Frankfurt's new Bird House features large, sunny, well-planted compartments. At the left an incubator operates in public view.

A Southern Sea Elephant dwarfs two Humboldt's Penguins outside Frankfurt's Exotarium, where all displays are extremely striking.



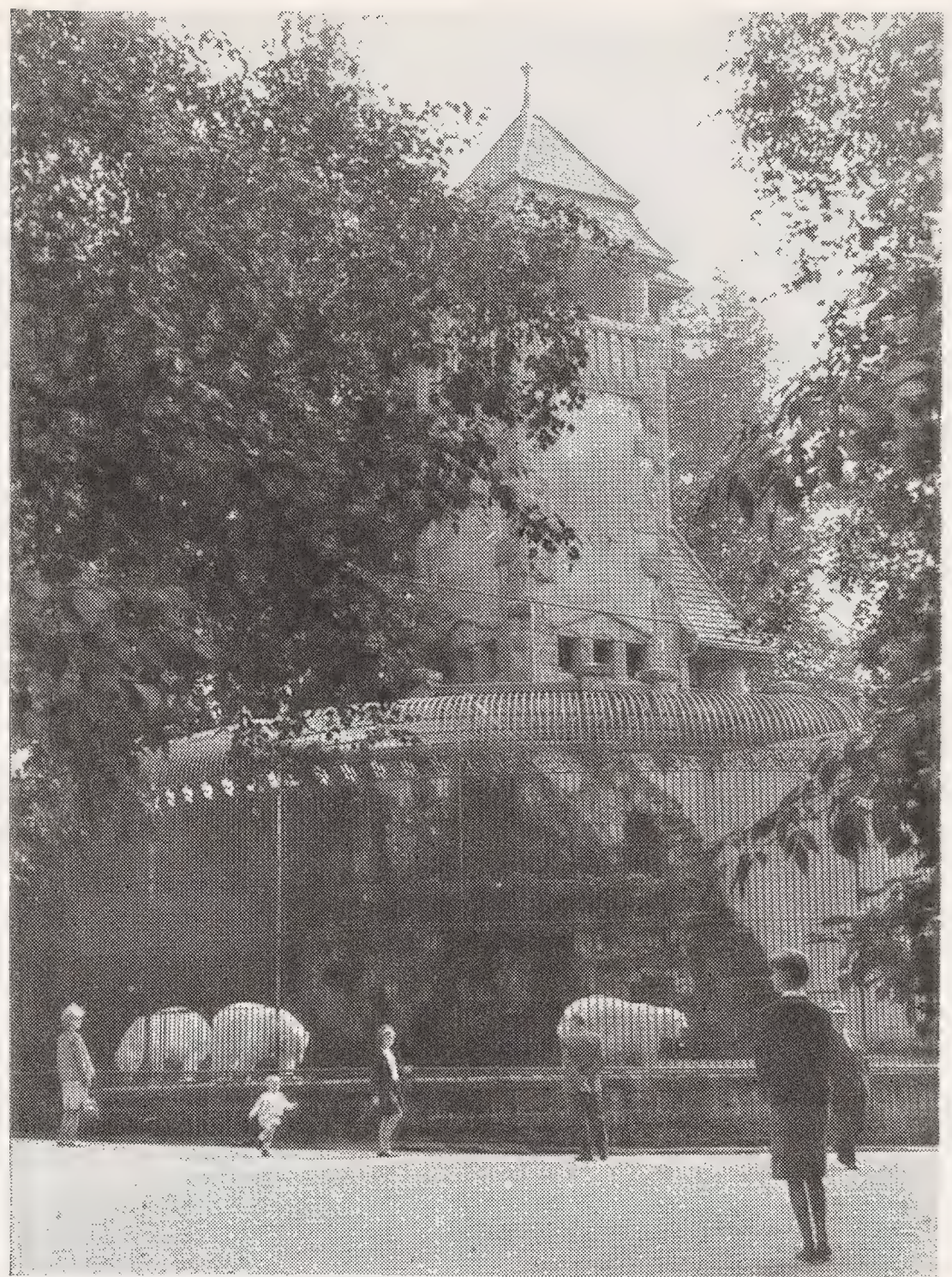
The Zoo opened in 1858 and is among the older zoos I visited. Yet despite an enormous elm with a plaque noting that "On October 31, 1813, Napoleon inspected his troops under this tree," much of the Frankfurt Zoo looks as though it was built only yesterday — and it was. At the Elephant House entrance is a sign, "Elefanten-Haus, built 1873, bombed 1943, built again 1954." The Frankfurt Zoo was bombed flat. Today most of the exhibits are entirely new or the result of a major renovation, and the most unusual of these is the Exotarium, a collection of striking displays ranging from a refrigerated Antarctic Penguin exhibit to a sectioned tropical American river combining fish, reptiles and breeding sun bitterns. But, as Bernhard showed me about his remarkable zoo, past a family of Clouded Leopards, past wonderfully rare Musk Deer, Yellow-backed Duikers, and Klipspringers and, of course, the finest breeding group of Gerenuk in captivity, I could see he was leading up to something special — the new Frankfurt Bird House. The Bird House is beautiful, a unique experience for any zoo-goer. Pictures are more adequate than words, but the building includes a Jewel Room ("Jewellen Halle") and a huge open-fronted "Walk-in" aviary separated from the

MÜNSTER

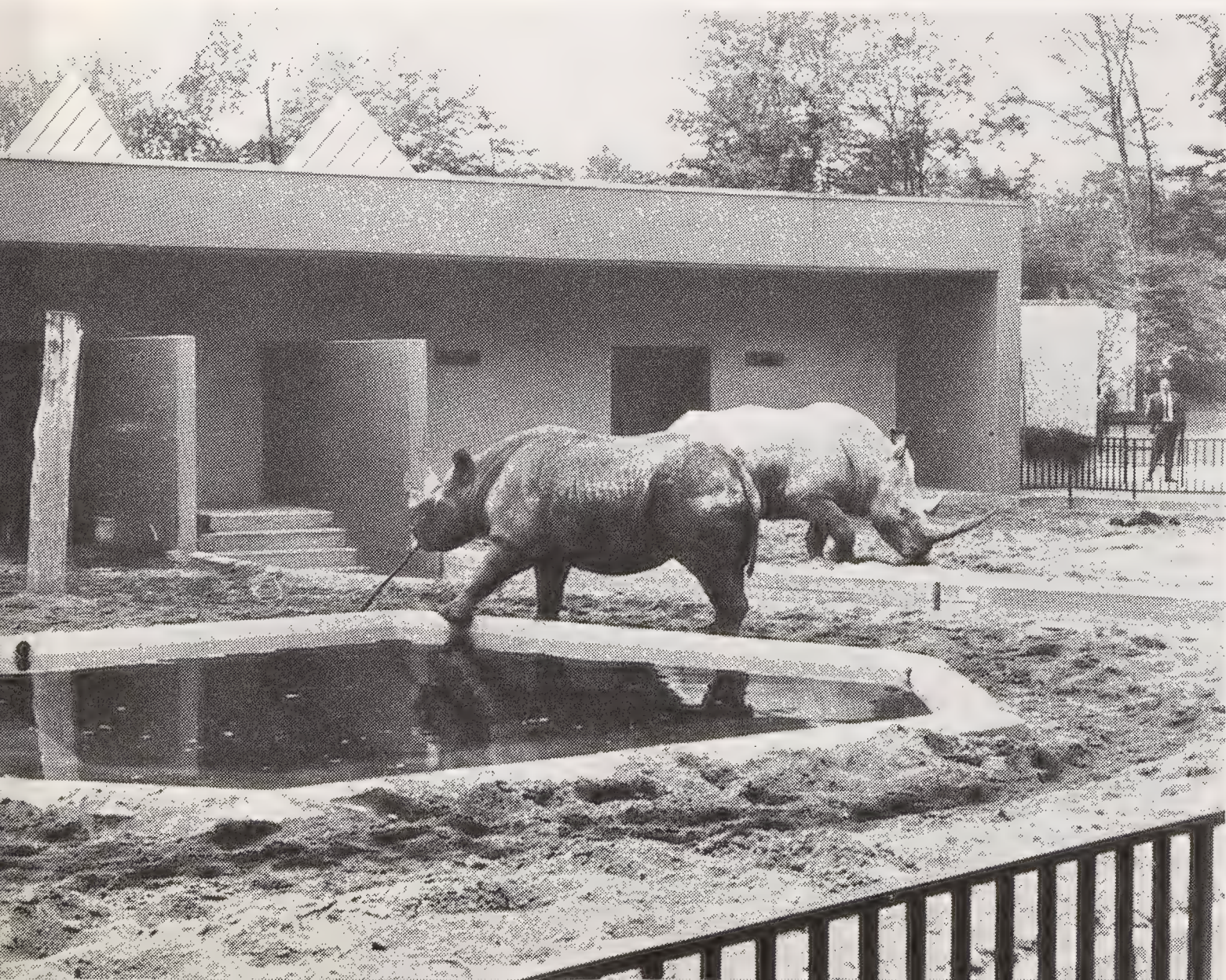
Zoological gardens would scarcely build such a display today, but Münster's old bear exhibits undeniably have a certain charm of their own.

rest of the structure not by a door but by a curious seraglio-like curtain of hanging plastic strings. A bird of paradise, which entered full display as I left the building, keyed the exhibit in the index of my memory. But before leaving Zoo Frankfurt, I took a few minutes to pay a visit to its famous hand-reared Andean Condor which, until recently, had been allowed to fly freely about the Zoo. Its present residence in a cage is the result of an acquired and expensive taste for automobile windshield wipers.

While construction or renovation was underway at every zoo I visited, it was generally, if necessarily, a piecemeal program. And at the Münster Zoo, opened in 1875, in a setting of older zoo exhibits, I found an attractive sign announcing the forthcoming construction of a Tropical House. Not so the Hannover Zoo where the entire garden was either just rebuilt, under construction, or scheduled for construction in an admirable and costly total renovation. The result should be a most attractive zoo with a planned public circulation and a continuity of architecture. For the present, I was more than satisfied to be able to photograph Maneless Zebras, a herd of that endangered antelope, the Addax, relative of another endangered antelope, the Arabian Oryx, and a pregnant elephant. But so much effort and construction to build a modern zoo in



one place could not help but call to mind the first really modern zoo anyplace, Stellingen, the Hagenbeck Zoo in Hamburg. One day in March, 1848, it happened that some fishermen brought, along with their regular catch, six seals to a Hamburg fishmonger named Hagenbeck. Mr. Hagenbeck decided to exhibit the seals, much to the delight of his four-year-old son Carl, we may suppose, in two large wooden tubs at his house in Spielbudenplatz. The idea was a success and the greatest of animal trading firms was born. Carl left school when he was fourteen, to devote his full energies to the animal trade, and by 1872



HANNOVER

A Black Rhino on the left and a White Rhino on the right. There is a fine collection of rarities in the Hannover Zoo, among them Maneless Zebras, Mountain Gorilla, Scimitar-horned Oryx, etc.



HAMBURG

Waterfowl, yaks, elephants, one after another in the distance — concealed moats and successive exhibits were the great innovations of Carl Hagenbeck in 1907. No one has done it better now.



Above — A concealed moat permits an exhibit seemingly combining big seals and Polar Bears. Left — A Tiger family enjoys the sun behind a water moat, resting on a massive artificial rock ledge.

This artificial mountain built nearly sixty years ago still is a striking backdrop for waterfowl, zebras and ostriches. It has weathered well and adds its own grandeur to the wild scene.



he was circus man Barnum's principal source of wild stock. In 1874, while importing reindeer, he decided to import some Lapps with them and thus began the first of a long series of "ethnographic exhibitions." Nubians, with camels, Eskimos with their dogs, Indians, Patagonians and Hottentots were all exhibited in Hamburg and often taken on tours elsewhere. By 1902, Carl Hagenbeck's properties in Hamburg had become far too small for his growing collections and he acquired a property called Stellingen. There, on a plot that now covers about 50 acres, he developed a park where mountain sheep were shown on artificial rock mountains and where lions were shown in open enclosures behind deep ditches — "moats." In short he developed the first modern "barless" zoo. It was opened on May 7, 1907.

Carl Hagenbeck died in 1913 and his son, who carried on the zoo, died in 1945. Carl Heinrich Hagenbeck, grandson of Carl, great grandson of

a fishmonger with an interest in natural history, graciously showed me the most important zoo in the history of animal exhibition.

A zoo man traveling from animal exhibit to animal exhibit tends to ignore familiar animals, after a while, and to concentrate on the technical aspects of the exhibit building. By the time I reached Berlin, I was in just such a state. Then I was suddenly called to account by a familiar face, the black, apple-headed face of a White-backed Trumpeter. Trumpeters are curious, chicken-sized South American birds with big and liquid brown eyes. I know bird faces, and this fellow looked like a Trumpeter that liked to talk

BERLIN

Right — Berlin's new Bird House has 154 exhibits and is by far the largest in the world. Below — Visitors walk among the birds in one huge area, through winding paths. The exotic planting gives a lush and quite tropical effect.



with Helen Tee-Van, wife of our General Director Emeritus, at the Bronx Zoo; I had learned the "language" and proceeded forthwith to get down on hands and knees and grunt hoarsely. Friend Trumpeter immediately strolled over to reply and we made Berlin's huge new pheasant aviary resound with low grunts and moans. The looks on visitor's faces eventually made me self-conscious, but I walked away secure in the knowledge that my Trumpeter vocabulary had passed muster even if my German was a bit lacking.

The Berlin Zoo has had a full share in the benefits of West Germany's "economic miracle" and today once again holds one of the world's largest collections. That zoos are terribly vulnerable in time of war is obvious, but Berlin's story is particularly shocking. Of approximately 4,000

animals in the Zoo, only 91 survived the war. One huge bomb is reputed to have killed eight elephants, two rhinoceroses, and seven pygmy hippos. A German bunker was located in the zoo and this led, in the Battle of Berlin, to ten days of fighting on the actual zoo grounds. Most amazingly, one bull elephant and one male hippopotamus were among the creatures which survived the war. Today, in the isolated city, the zoo is an especially important focus of recreation for Berliners, but it fights many supply and disposal problems and is very fortunate in its competent staff and director.

The zoo's director, Dr. Klös, showed me, with justified pride, Berlin's recently completed new bird house. With 154 cages it is by far the largest in the world and already exhibits such rarities as a Picathartes and a Giant Touraco. Happily, the zoo's breeding record is keeping pace with its new exhibits, and I saw Berlin-bred crowned pigeons, Mountain Zebra, Gaur and Banteng, and as I left the Zoo I saw the first captive-bred flamingo to be reared in Germany.

Leaving the oldest of German zoos, I flew to London to see the oldest of British zoos and there the first sign to catch my eye was:

LONDON

Squat domestic Yaks are a contrast to graceful Giraffes in London's remodelled Giraffe House, originally built in 1836. Like other old zoos, London is now being modernized and has one of the largest collections in the world today.





The First Giraffe in England

George IV was presented a Nubian Giraffe by Mohamed Ali, Pasha of Egypt.

Painted by James Agasse
Lent by H. M. the Queen

So reads a label, dated 1827, on a large painting which faces the visitor who enters the offices of the London Zoological Society at Regent's Park. A feeling of tradition inevitably pervades the hall, and it should, for the London Zoo was opened in 1828 and is thus the oldest of major zoos still extant (the smaller gardens, Jardin des Plantes in Paris and Schönbrunn at Vienna, are older, of course). Today, though it includes only 36 acres, the London Zoo houses one of the very largest of wild animal collections and, like other old zoos, is in the throes of modernization. My interest was caught by a variety of details and by many rare creatures. In the Children's Zoo, for

Whipsnade, London Zoo's adjunct in the country, contains about 500 acres and is a magnificent setting for large herds and flocks. This huge paddock contains White Storks and Fallow Deer, all existing peacefully together.

example, I found a jukebox with records offering zoological lectures. In the Bird House, I was delighted to see the same African Tick Bird I had admired in 1958 and, in yet another building, I examined with envy an exquisite pair of Royal Antelopes, tiny creatures hardly as large as a cottontail rabbit. My old friend, Bird Curator John Yealland, and later Zoo Yearbook editor Caroline Jarvis, acted as guides and the discussions ranged over such esoteric subjects as the colonization of Great Britain by Baltimore Orioles and the zoo-cricket-colony's weekly cricket production — which is 1,600. With all its activities the London Zoo is a cramped place for hoofed animals and, in the early 1930's, the Society acquired 500 acres of land away from the city in

England's beautiful countryside for the establishment of a farm zoo. It is called Whipsnade.

As usual it was raining and Harold Tong, Whipsnade's efficient Director, thoroughly accustomed to the Englishman's element, walked about hatless and coatless. I had seen a wallaby on the way to the office and asked if they had more. "Yes," came the answer, "about 160 or 170 I should say." And these proportions are typical of Whipsnade. While it keeps a few animals in pairs, notably Indian Rhinoceroses which it has bred twice, Whipsnade is a zoo of herds. Herds on vast green meadows often composed of startlingly mixed species. One group, whose contrasts particularly tickled my funny bone, consisted of Bactrian Camels and South Ameri-

CHESTER

Nine large Chimpanzees live on grassy islets in the Chester Zoo, surrounded by amazingly shallow moats. There have been a few escapes, but now an electric wire above the water serves to stop them.

can Tapirs! Contrasts notwithstanding, Whipsnade presents lovely vistas and is a testimony to farsightedness.

A testimony to the efforts of one remarkable man is the Chester Zoo, site of the 1963 International Zoo Meetings. George Mottershead got the zoo under way in 1931, and its site includes nearly 170 acres. In recent years, the zoo has been the scene of a remarkable building effort, for by virtue of his own engineering knowledge and with a ridiculously small crew of zoo construction workers, George has recently completed a most attractive and inexpensive Elephant House, a Rhino Building and a Primate House. Chester's flowers are also celebrated in the zoo world and when I inquired about a bright bed of marigolds in front of the Lion exhibit, I was told the flowers are used to keep the public away from the Lions!

Chester's rarities include a pair of Mountain Gorillas, White Rhinoceroses, and a Tuatera. But the most exciting exhibit in the zoo, and among the finest exhibits in any zoo, are the





Above — White Rhinoceroses graze side by side in a new enclosure. Right — could this pose by Chester's elephants imply disappointment or disapproval of the regulation prohibiting feeding by the visitors?

superb Chimpanzee Islands. Nine big Chimpanzees have the run of several large grassy islets. They are separated from their public by a simple thigh-deep water-moat and they are a grand sight! Because of the moat's shallowness a few escapes have occurred and on one such occasion, as an adult male chimp came strutting down the walk, it is alleged that prudent keepers jumped into the water. And I can well believe it, for an adult male Chimpanzee is a formidable creature. Now an electric wire in the middle of the water moat has eliminated the Chimpanzee problem — though a resourceful orang on another island has learned that he can still fraternize with the visitors if he short-circuits the wire with wet reeds.

As I close my notebook with its squiggly diagrams and curious floor plans and begin to sort pictures of strange animals in manmade homes, it occurs to me that I should like to write one more sentence about this zoo trip. The next time you go to a strange city — go to its zoo!



BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM
AND THE DEPARTMENT OF TROPICAL RESEARCH

Gray Seal Pup Is Born at the Aquarium

The birth of captivity-bred seal pups is a rare event and the New York Aquarium added to the scanty records on January 8 when a healthy female pup was born to a pair of Atlantic Gray Seals, *Halichoerus grypus*. (A second pup, from the Aquarium's other adult female, was born on January 28).

The baby weighed 27½ pounds at birth and in typical seal fashion put on weight rapidly. Two weeks after birth it weighed 109 pounds. The rapid growth is not surprising, for seal milk, with 50 to 55 per cent butterfat, is the richest milk known.



One of two Wattled Cranes incubator-hatched in mid-December after preliminary incubation out-of-doors by their parents. They grow surprisingly fast and at 4 weeks were 20 in. tall.

The baby's mother was captured in the Magdalen Islands in the Gulf of St. Lawrence in 1958 when she was about a week old. The father was about two weeks old when he was captured in the same area in 1960. Their successful breeding indicates that mating may occur earlier than was previously known.

Dr. Dowling Represents Society at Ceremony in Galapagos

Dr. Herndon G. Dowling represented the Zoological Society at the dedication of the Charles Darwin Research Station in the Galapagos Islands on January 22. The station, whose creation was aided by the Society, is on Santa Cruz and is a center for research by visiting and resident scientists. Dr. Dowling made a two-months' expedition to the Galapagos in 1962 and on his current visit will spend another month in observations on Galapagos tortoises, marine and land iguanas and other fauna.

Aquarium Asked to Continue Work in Antarctica

Representatives of the National Science Foundation have inquired about the possibility of the New York Aquarium continuing its work with marine mammals as part of Operation Deepfreeze in Antarctica, on a year-to-year basis. The Zoological Society has agreed to do this, and another Aquarium expedition may be sent to Antarctica during the 1964 Antarctic summer.

Three Weddell Seals (which will be discussed at length in the next issue of *Animal Kingdom*) were brought back by Dr. Carleton Ray and his associates early this winter. The next expedition may provide other Weddell Seals for exhibition and study at the Aquarium.

IN BRIEF

Chameleon's Tongue. Made curious by a comment in *Animal Kingdom* that the giant African



Wisents, or European Bison, are forest animals and we now are exhibiting our family of three in a large and well-wooded setting. They were moved to their new home on a forested slope just east of the Roosevelt Elk range on December 23 and are clearly visible, even to small children, beyond the low, inward sloping barrier fence adapted from the Rotterdam Zoo's design.

Chameleon, *Chamaeleo melleri*, can shoot out its tongue to a length of 10 inches, Keeper Peter Brazaitis of the Reptile Department made fifteen observations of one 10-inch chameleon now in the collection. By means of a ruler measuring the distance from the mouth of the reptile to its prey — a cricket — he determined that the tongue shot out for various distances from 10 inches to 14½ inches.

Camels in the Snow. With the arrival of a new Dromedary for the Animal Riding Track, a male and female Dromedary have been moved to the site of the future Wildlife Survival Center, formerly the Farm-in-the-Zoo. Except on the coldest days, and even during periods when heavy snow covered the ground, the camels have been out of doors and have attracted much attention from motorists on the Bronx River Parkway alongside the Center. Camels are becoming difficult to obtain and we hope to produce our own supply from the breeding pair.

Book Reprinted. A facsimile reprint of "The Physiology of the Pituitary Gland of Fishes" by

Dr. Grace E. Pickford and Dr. James W. Atz has been published by the Zoological Society. The original edition, published by the Society in 1957, was completely sold out and a continuing stream of orders, especially from foreign countries, led to the decision to reprint the 613-page book. Price of the reprint is the same as that of the original, \$6.00.

Dr. Nigrelli Honored. Dr. Ross F. Nigrelli, the Aquarium's Pathologist and Director of Research, has been awarded the Order of Merit of the Societe d'Encouragement pour la Recherche et l'Invention of France. The award was made in recognition of Dr. Nigrelli's work, in France and at the Aquarium, on the metabolites of the sea.

Housekeeping in the Tropics. In her periodical report from Simla, the Society's Department of Tropical Research Station in Trinidad, Director Jocelyn Crane gives a "housekeeping hint" of practical import in the tropics — if not in the temperate zone. Following a storm, she wrote, "Owls and frogs called as usual. Katydid flew in. At eight o'clock a huge swarm of winged ants

dimmed the lights in the laboratory. As usual, most of the ants soon dropped to the tiled floor, where they shed their wings, squirmed about and got nowhere. Once more we followed a practice started last July by one of the research men. We brought in nine huge toads from the garden, settled them strategically around the room and went about our business. The toads, too, went promptly to work and spent the evening cleaning up, tongues shooting, throats gobbling, eyes popping. At bedtime we picked them up and put them out. And the floor looked freshly swept."

Housekeeping in the Zoo. The foyer of the Administration Building at the Zoological Park is undergoing a face-lifting. Handsome wood paneling, an acoustical ceiling and an asphalt-tiled floor are being installed, the telephone switchboard is being inclosed, and one wall will bear a large bronze medallion of the Society's seal.

First Birth of 1964. Although we can generally count on our large and thriving Nyala antelope herd producing mid-winter babies — often the last birth of the old year and the first of the new — the distinction was taken away from the herd this year by — of all animals! — the Palestine Spiny Mice. Two tiny babies born on January 8 were the first births of 1964.

PUBLICATIONS OF INTEREST

EXPLORING OUR NATIONAL WILDLIFE REFUGES. By Devereux Butcher. Revised Second Edition. 340 pp., 350 photographs. Houghton Mifflin Co., Boston, 1963. \$6.50.

To many people, our National Wildlife Refuges offer more attractions than our National Parks — likely to be less crowded, for one thing. This revised edition of a book first published in 1955 is a practical and inspiring guide to the refuges — how to get there, what you may see, something about their history.

"I NAME THIS PARROT . . ." By Arthur A. Prestwich. 2nd edition, 162 pp. Published by the author at Edenbridge, Kent, England, 1963. 21 shillings.

Who were the persons for whom many scores of members of the Psittacidae have been named? Who, for instance, was the Josephine whom *Charmosyna josefinae josefinae*, "Josephine's Lorikeet," commemorates? These "Brief biographies of men and women in whose honour commemorative names have been given" will interest any parrot-fancier.

CAROLINA LOW COUNTRY IMPRESSIONS. Text by Alexander Sprunt, Jr., 77 line drawings by John Henry Dick. 192 pp. Devin-Adair Co., New York, 1964. \$10.00.

Mr. Sprunt, the well-known ornithologist, has written an agreeable text to accompany Mr. Dick's lovely black-

and-white drawings of birds, mammals, reptiles, houses, insects, flowers.

THE QUIET CRISIS. By Stewart L. Udall, with an Introduction by John F. Kennedy. xiii + 209 pp., 32 pp. of illustrations in black-and-white and color. Holt, Rinehart & Winston, New York, Chicago & San Francisco, 1963. \$5.00.

There is a tendency in all civilizations to draw farther and farther away from the land that gives them life. This is perhaps especially true of America, where pollution of air and water, demolition of forests and wild life, and erosion of productive soil proceed at accelerating pace, too often unnoticed and unknown. Secretary Udall's book presents both a history of these threats to the well-being of our nation and a summary of steps that must be taken if their progress is to be checked. Coming from what must be taken as an official source, this fine book will be welcomed by all conservation-minded readers. — L.S.C.

THE WILDERNESS IS FREE. The Story of Wild Life in Africa. By C. A. W. Guggisberg. 142 photographs, many in color, by the author; 158 pp. Howard B. Timmins, Cape Town, 1963. 39 shillings.

Excellent photographs, mostly of mammals and birds, taken in East Africa by the author of "Simba." The brief text with each photograph gives pertinent natural history information and often makes a strong conservation plea.

THE PLANTS. *Life Nature Library.* By Frits W. Went and the editors of *Life*. 194 pp., many photographs and drawings, mostly in color. Time, Inc., New York, 1963. \$3.95.

Dr. Went is Director of the Missouri Botanical Garden in St. Louis and, as if this were not enough distinction, a scientist with a delightfully easy, informative style. Like other books in the *Life Nature Library*, this is an outstanding beautiful publication.

CLASSIFICATION OF THE ANIMAL KINGDOM. By Richard E. Blackwelder. Southern Illinois Univ. Press, Carbondale, Ill., 1963. iv + 94 pp. \$7.00.

This attempt at a complete classification of the animal kingdom, including both recent and fossil groups down to the ordinal level, may be a very helpful tool for teachers and advanced students. It contains a number of new, and therefore controversial, arrangements and some new names for previously-recognized groups.

To a herpetologist it seems a shame that the author used Romer's "Vertebrate Paleontology" (1945) classification of reptiles rather than the more recent arrangement in his "Osteology of Reptiles" (1960). Although Blackwelder included extinct classes, unlike Lord Rothschild's (1961) "Classification of Living Animals," he did not include suborders, which were listed by the latter.

As compared with Rothschild's \$4.75 work of similar length, the price seems excessive. — H.G.D.

A HISTORY OF DOMESTICATED ANIMALS. By Frederick E. Zeuner. 560 pp., many illus. Harper & Row, New York, 1964. \$12.00.

Prof. Zeuner (Environmental Archaeology, University of London) has brought together an enormous amount of information — his bibliography runs to 29 pages — which his archeological training permits him to evaluate. Many questions of "where" and "how" he does not attempt to settle, but pushes the record back as far as cave drawings, coins, art objects of many kind — even radiocarbon dating — will allow. The origins of more than forty domesticated mammals, birds and insects are discussed.

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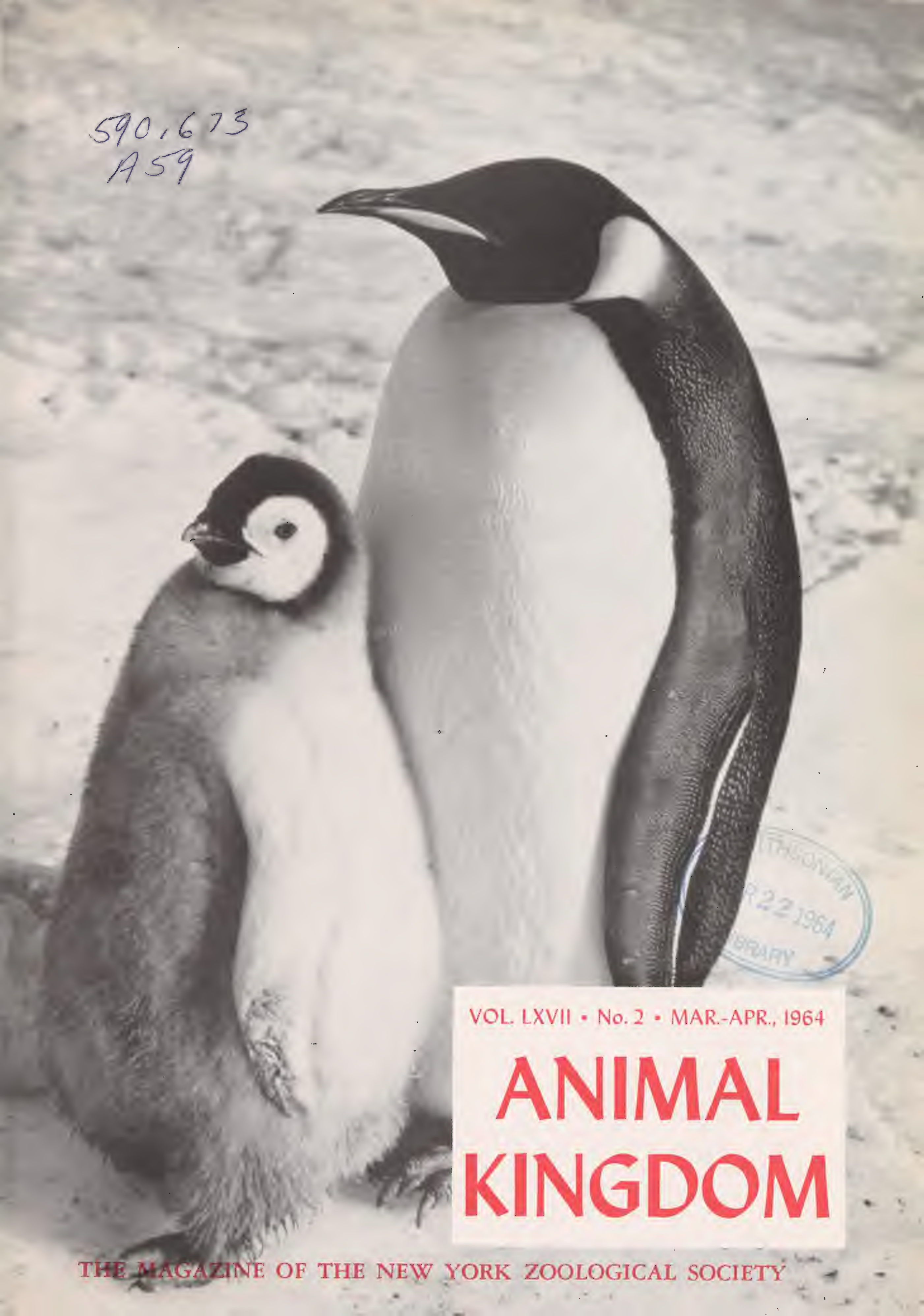
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ANIMAL KINGDOM

THE MAGAZINE OF THE NEW YORK ZOOLOGICAL SOCIETY

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ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

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A Seal Comes to Town

THE ARRIVAL at the Aquarium of an infant seal, with its two Tolder companions, from the far reaches of the ice-covered Weddell Sea in the Antarctic was in itself a memorable incident. Unperturbed by a long trip in a jet plane, unafraid of the strange human figures that hovered around them, untroubled, apparently, by the appearance of their new quarters, they settled down instantly, as if to say in human terms — "Let's take life as it is and not as it has been."

This happened several months ago. They have flourished ever since. The infant, by the way, took its first swim in the cold ocean-water pool the morning after its arrival and, for those interested in statistics, has increased in weight from 146 lbs. to more than 250 lbs. in 120 days — flourishing indeed!

While this incident was memorable *in itself*, it has many implications. Above all, it illustrates vividly the differences in the capacity of wild animals, and for that matter, of all living things, including humans, to adapt themselves to a new environment. We see much of this at the Zoo as well as at the Aquarium when wild creatures come into our care. There are not only variations between species but variations between individuals of the same kind. The causes of many of these differences are little known.

The Weddell Seals are a rather special case. While in the water they are subject to attack by Killer Whales. When on land they have no natural enemies. Consequently, one might conclude that they are relatively free of fear, but this barely explains their tranquil attitude on their trip and their arrival at the Aquarium.

A number of different species of antelope from Africa live in similar environments. All of them are subject to being preyed upon by their natural enemies, such as the Lion, the Cheetah and the Hyena. Yet upon arrival at the Zoo, they reveal varying temperaments and psychological characteristics. Some are stolid, like the Eland. Others are extremely temperamental and fearful, like the Lesser Kudu. While the Eland is much the largest, size is not the only factor.

In order to gain greater knowledge of questions such as these, and many others related to them, our Society is initiating a new department to be known as the Department of Behavioral Sciences, to be established at the Zoological Park. It is a plan that evidently contains unlimited potentialities for gaining a fuller understanding of the causes that motivate the actions of animals, causes, it must be added, that in many instances influence the actions of man as well.

Fairfield Osborn

ENTOMOLOGICAL
INSTITUTION

APR 22 1964



STUDYING THE WEDDELL SEAL IN





ANTARCTICA

By CARLETON RAY

Associate Curator,
New York Aquarium



NO ANIMAL voluntarily exposes itself to the harshest environment available to it. Like human beings, it most often seeks the easy way out. Then why do those two most cold-adapted warm-blooded animals on earth — the Weddell Seal and the Emperor Penguin — seldom leave the shores of Antarctica, even in the frozen night of winter? The Emperor Penguin breeds and incubates its egg in the midst of this night. The Weddell Seal frequents the pressure ridges and ice cracks of Antarctic shores the year around, keeping access to open water even when the temperature reaches 60 degrees below zero, or lower. Why? — or more pertinently, how?

There are significant biological implications in the investigations of these simple questions. The whys and hows are the business of the scientist, in this case the field biologist, and in the year called Deep Freeze 64 the New York Zoological Society was a part of the immense assault on the least-known continent, an assault which had begun in earnest with the International Geophysical Year in 1957. I was the Principal Investigator*

Top — Showing curiosity more than fear, a female Weddell Seal allows Murray Smith to approach her. Only rarely does a seal try to escape to water. Below — A rookery of the big Emperor Penguins at Cape Crozier.

All photos by author unless otherwise credited.

on a project rather formidably entitled "The Physiological Ecology of the Weddell Seal, *Leptonychotes weddelli*" — in other words, the natural history of the Weddell Seal and the "how" of its growth, regulation of body temperature, nutrition, microbiology and ice-hole-finding underwater.

We were a team of three: Elmer T. Feltz, microbiologist from the Arctic Health Research Center in Anchorage, Alaska; Lt. David O. Lavalley, U. S. N., underwater technician; and myself. This was to be a survey year for us, a time to "zero in," so to speak. For very little is known of the physiological ecology of the Wed-

* The work described in this article was supported by a grant to the New York Zoological Society by the National Science Foundation. Field support was given by the Commander, United States Naval Antarctic Support Force.

dell or of any other Antarctic or Arctic seal. In fact, it can be said that the marine animals, Pinnipedia and Cetacea alike, are the least-known of all mammals, and that the polar species are the least known of their tribes. A significant part of our work would be an attempt to bring living Weddell Seals back to the New York Aquarium for concurrent exhibition and further study under controlled conditions.

The inclusion of Lt. Lavallee, a Navy diver, reflected a major philosophy of our plans: "If you want to study a seal, be a seal!" We are land mammals. Seals are not, most of the time, and I do not hold with the theory that laboratory study of animals is necessarily the best sort of study. To get some answers, we must first go to nature, *then* use the laboratory for refined techniques either not possible out of doors or best referred to controlled conditions.

The scene of our investigation was Ross Island in the Ross Sea of the Antarctic Ocean. It forms the eastern border of McMurdo Sound and is perhaps the most historic of all Antarctic locations, for it was here that two of the three greatest men of the heroic age of Antarctic exploration made their bases: Capt. Robert F. Scott at Hut Point, 1902-1904; Sir Ernest Shackleton at Cape Royds, 1908-1909; and Capt. Scott at Cape Evans, 1910-1913, for his conquest of the South Pole, on which journey he died. The third of this triumvirate was, of course, Roald Amundsen, who based near the eastern border of the Ross Sea and was the first man at the South Pole, only days ahead of Scott.

Today Hut Point bustles with activity, just yards from Scott's base, as part of one of the greatest scientific investigations in history. Since the IGY, and even more since the signing of the Antarctic treaty of 1959,[†] which provides that this continent (as large as the United States and Europe combined) would be used for peaceful and scientific purposes only, McMurdo has been the open door through which access to Continent Six is gained by more than 300 scientists and 3,500 support personnel of the United States Antarctic Research Program. USARP, as it is called, is administered by the National Science Foundation.

[†] Signatories are Argentina, Australia, Belgium, Chile, France, Japan, New Zealand, Norway, Union of South Africa, United Kingdom, United States and the U.S.S.R.

The land of Antarctica is so hostile that not a single terrestrial vertebrate lives there. All bird and mammal life depends on the sea, one of the richest of all seas. The Antarctic differs drastically from the Arctic because of a simple geographic fact: it is a land surrounded by sea whereas the Arctic is a sea surrounded by land. Thus the barriers to dispersion of Antarctic life are different from those in the Arctic; the behavior of animals is different—more trusting, if that is a permissible word. The Antarctic is a desert surrounded by a rich aquatic doughnut wherein lives the world's greatest concentration of marine mammals, both pinniped and cetacean.

Of the two marine incursions into continental Antarctica, the Weddell and Ross Seas, the latter is slightly more southern in its extent of open water north of the Ross Ice Shelf. It extends to about 78 degrees South Latitude and therefore the Weddell Seal, which habitually hugs the edge of open water, can be said to be the most southerly resident warm-blooded animal, beating even the Emperor Penguin out by a few miles.

The howling winds of Antarctica are legendary. They make even colder the temperatures which fall well below -60° F. at McMurdo in winter and even in the short Antarctic summer rise above the freezing point by about 5 degrees at most.

Our research party stepped from a Super Constellation onto the McMurdo airfield on the Ross Ice Shelf on Friday, October 18, after some ten hours in the air from Christchurch, New Zealand. We were told that the temperature was 20 to 30 degrees below zero, but so dry was the air that it did not chill much more than a breezy January day in Rockefeller Plaza. In any event, we were dressed for it, in layers of light, puffy clothing, parkas bright red with U. S. ANTARCTIC RESEARCH PROGRAM in blue over the left breast pocket.

Our specific base of operations was the Bio-lab of McMurdo under the direction of Dr. Donald Wohlschlag of Stamford University, and we were immeasurably aided in our sealing by Gerald Kooyman of the University of Arizona and Murray Smith, another seal student, from New Zealand's Scott Base just over the hill from McMurdo.

The Weddell Seal is an animal of the ice fissures, the pressure ridges and broken ice of the



Top — Seals have formed a colony alongside a natural crack in the ice, through which they can get to the water. Right — By sawing motions of its teeth a seal made this hole at a cracked spot in the ice.

shore and glacier tongues. Except in the best weather it is seldom to be found resting in the middle of large floes, entirely exposed. When it is hungry — and water is the only source of its food — it does not drill through thick sea ice to reach the water, even though the powerful neck and heavy canines and incisors of the upper jaw are capable of efficient ice-cutting. Natural cracks and pressure ridges make life a little easier than that. The Weddell Seal takes advantage of these fissures to enter and leave the water, keeping them open through continual use and by a characteristic side-to-side sawing motion of the upper teeth against the edges. The jaws can actually open almost 150 degrees and the sawing action on the ice is surprisingly effective. So ingrained is this behavior that our large female, “Elsie,” at the Aquarium continues to saw at the water in her pool despite the absence of ice. She merely showers water in all directions.

The seal’s habitat of ice cracks and pressure ridges has thermal implications. The irregular ice affords some protection from wind and blizzard. At wind velocities of more than 20 knots (and each knot of Antarctic wind is estimated to lower effective air temperature by 1° C.), the actual ground velocity behind a thrown-up pres-



sure ridge may be scarcely 0-10 gusty, a mere eddy with little bite in it. When things get too rough and cold, the Weddell does what any Walrus or Arctic seal would do — it enters the cold but otherwise weatherless water. All conditions on ice and snow are not cold, as any skier knows. When the sun is out and the wind is down, snow reflecting up to seven-tenths of its incident radiation can be hot and the radiation can burn badly. I have seen men almost pass out with heat prostration on glaciers at 55 degrees F.

Seals love still, warm days and can best be observed at such times. A lucky thing, too, for those were the only days when we could reach



Three females, each with her pup, lying on the ice at Turtle Rock. The pups do not swim until they have developed blubber; before that time, their thick, woolly fur acts as an insulator.

them. Our first journey to the colonies of Erebus Bay and the Delbridge Islands was made by helicopter on Saturday, October 19. We found some forty seals at Little Razorback Island just north of Glacier Tongue, looking for all the world like an assortment of slugs on the ice. Cleanliness is *not* a seal virtue ashore; the location was marked by volcanic soot, feces and bloody afterbirth from two females that had pupped a couple of days before. Weddell coats are a lustrous dark gray with light flecks dorsally and larger irregular patches of light gray to white ventrally. Their bodies are huge and fat, pregnant females grotesquely so, and the heads are huge-eyed but disproportionately small. Here and there we saw holes in the ice, some with a seal's head protruding and others sheltering a hidden animal, as we could tell by the water moving in the hole. There are no land predators in Antarctica and so these seals have no enemies on ice and know no fear above water. Occasionally a female with her pup will show some aggression toward an intruder. Like all seals in my experience, they really do not like being handled and their first reaction to a man is most often to roll on the side or back with head cocked full-eyed to the object of their curi-

osity. If you halt your approach, the animal returns to rest. Come closer and it may try to escape by a caterpillar-like hunching away, usually furtively and not far, or it may resort to an open-mouthed cat-like crying or complaint, which rarely ends in escape to the water. All in all, its escape behavior is so meager that, of all the species of animals with which I have had personal experience, I think there is none more easily worked in the field than the Weddell Seal.

Our work was divided into four parts: seals on the ice, penned animals confined but otherwise not molested, underwater observations, and shipment of specimens to the New York Aquarium. Eventually our detailed scientific findings will be published in the Zoological Society's journal, *Zoologica*, and elsewhere.

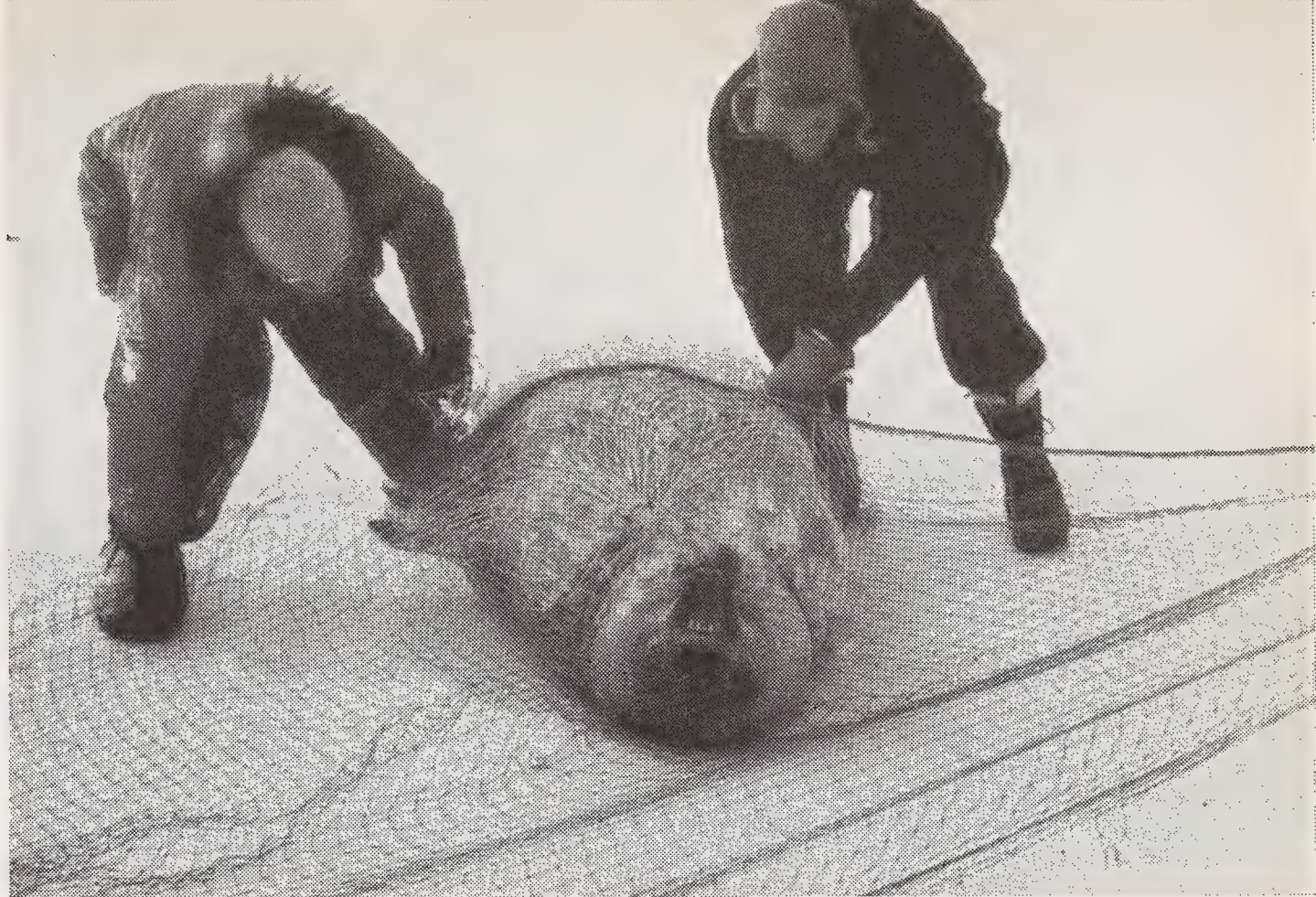
Thermal characteristics of the Weddell Seal were measured by a telethermometer, an electronic device that gives quick, accurate readings on a dial some feet away when the fur and skin are probed by the sensing rod. I was able to probe different parts of the bodies of seals while Murray Smith read out the temperatures and did the recording at the other end of a 30-foot wire. We worked only with dry, resting animals to determine the insulating properties of baby lanugo fur and adult blubber. Blubber, as we know, is an efficient insulator and the pup's thick, woolly fur is its thermal counterpart, so that the baby's skin never falls much below 87° to 92° F.

whereas, in cold weather, the skin of the adult can fall to near the freezing point. Until the pup develops blubber, it does not swim, for wetness would penetrate the fur and chill the skin. Baby seals are therefore better off in below-freezing temperatures when water is in a solid state and thus dry, than above freezing when their coats would be wetted through. Wet a newborn seal pup and its skin temperature drops; it will die of exposure unless dried very soon.

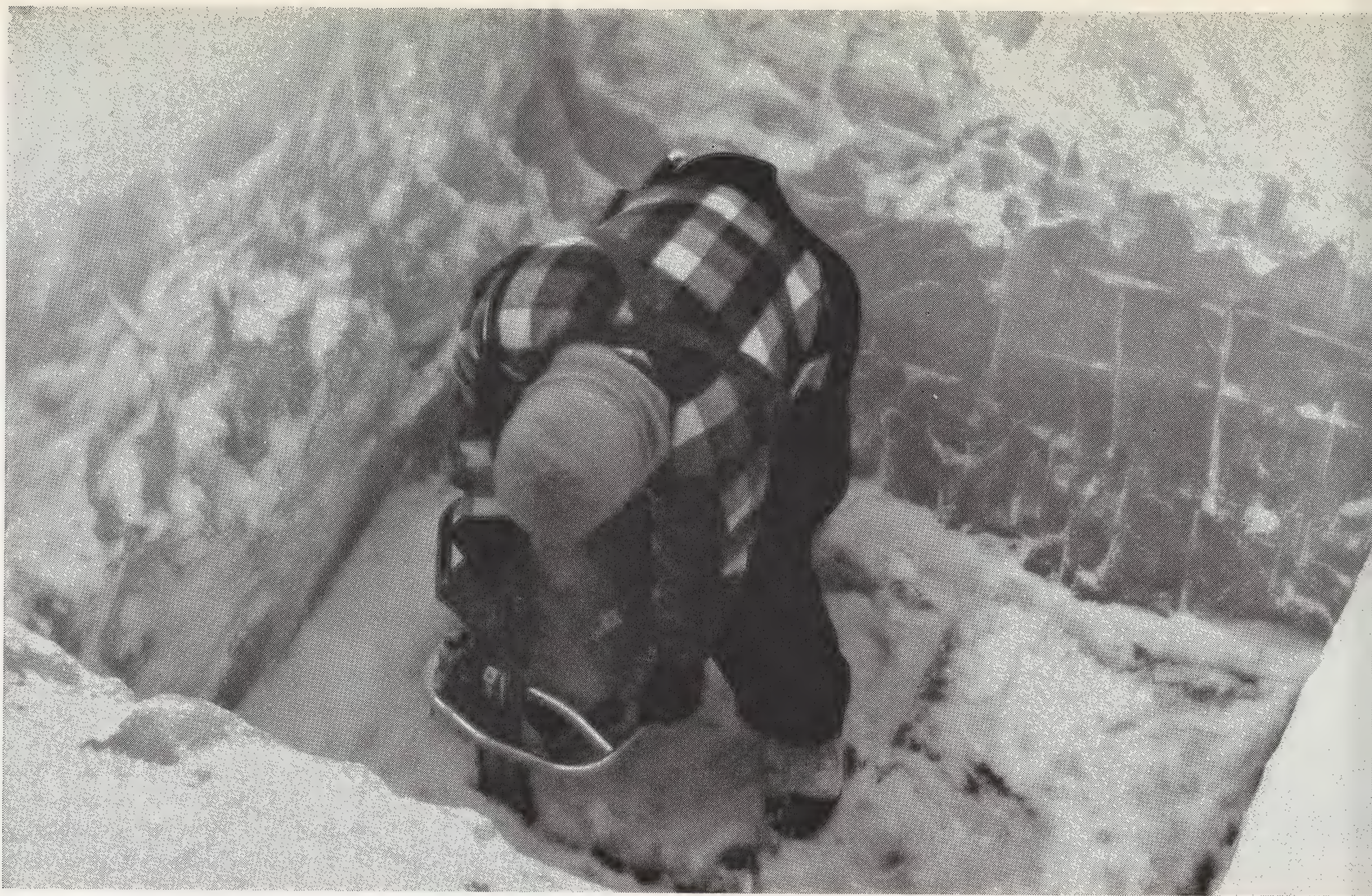
Our microbiological work involved swabbing seals and penguins orally and rectally. As subsequently analyzed by the laboratories of Beth Israel Hospital in New York, it shows that both seals and penguins of the area have a flourishing intestinal bacteria and are far from the sterile conditions sometimes reported for Antarctic animals. Are these bacteria characteristic of these animals, and new species, as our previous Arctic work indicates may be the case? Or has there been local contamination? It is too early to tell.

The second phase of our work, on penned animals, continued in more detail the thermal and microbiological work done on the ice. We used the helicopter capture methods developed for Harp and Hood Seals in Canada by Curator Montreuil and myself in 1962. There were differences, however; Weddell Seals are much stronger than Harps or Hoods and I have a strong impression that they don't like the cargo nets used in their restraint and lifting by helicopter. But, like Harps, Hoods and even walruses, they cease struggling once they have been lifted from the ground. Two mothers were captured on October 24 and transported to pens while their babies were carried inside the helicopters. Two hours after capture, both penned babies were nursing. The pup now at the Aquarium grew from about 70 pounds at birth to 155 pounds just before leaving McMurdo three weeks later.

From various tests of penned seals, it appears that the heart rate and action are typically mammalian and that the metabolism, as has been



Top — A net has been thrown over an adult female, in preparation for removal to the pens. Center — A helicopter made transport easy. Bottom — Holding pens had to be stoutly built. McMurdo is beyond.



shown for other seals, is higher than the normal mammalian rate—to be expected in a cold aquatic existence.

Underwater work on behavior and acoustics was perhaps the most difficult phase of the investigation. The water was at 28.6° F., exactly at the sea's freezing point. To go under the ice and return comfortably, we decided to operate in a small house moved over a 4-by-4-foot hole in the 7½-foot-thick ice. It took four of us two days to cut through that ice with chain saw and ice chisel. Sawing and chipping downward toward the water, you are always in danger—near the finish—of punctuating the last few inches of ice unexpectedly and getting a cold dunking from below. That very thing happened to Lt. Lavallee but he scrambled out of the hole safely before he had to swim.

Before any extensive attempt to “study a seal by being a seal” underwater, we had to learn our own capabilities and limitations. Lt. Lavallee and I dressed in specially designed wet suits and dropped into the water through our man-made ice hole for the first time on October 27. What greeted us was a remarkable sight. The Antarctic plankton bloom had not yet begun to cloud the water and we could see dimly almost 200 feet horizontally, into a crystal-blue hydrosphere. The water held ice crystals in suspension and the

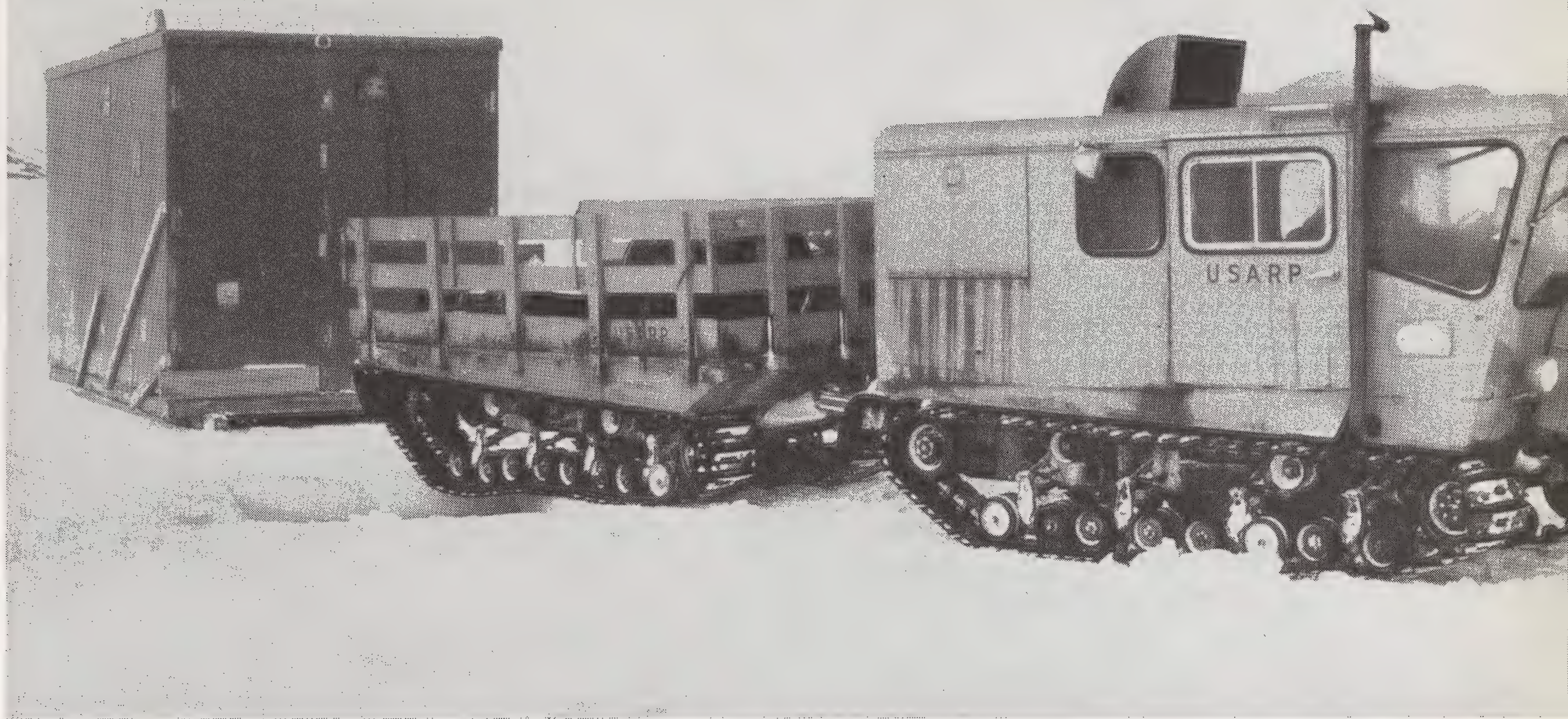
The ice was 7½ feet thick and for divers to gain access to it, a hole was cut with a power saw. The only tricky part came when the cutter began to break through and remove the last ice. Then there was danger of a dunking.

underside of the ice was frosted with wafer-like crystals. By the next day delicate crystals had accumulated on lines and the diving ladder, much as rock candy encrusts a string. We did not stay under for long on the first descent, for it was merely a test for suit leakage. Out of the water and exposed to a 10-to-20-knot wind and air at 20° F., ice formed on the diving suits but we remained warm inside.

Subsequently Lt. Lavallee subjected himself to tests in which he remained motionless for 30 minutes, during which time I recorded physiological data. We satisfied ourselves that men can operate under ice in Antarctic waters at depths of 75 feet and for up to a whole hour in relatively simple gear.

Repeated submersions advanced the work, for in the course of them Lt. Lavallee recorded the underwater trill of the Weddell Seal, a sound which almost surely has an echo-location potential for helping the animal to find its way about when sight is useless.

On November 7 we had our first encounter



Top—Once the hole was cut, a tractor dragged a hut over it. Right — Dr. Ray (facing the camera) and Lt. Lavallee in diving suits inside the hut; they made many descents into the water to make observations on the Weddell Seals.

Right photo by R. Lytell, courtesy N.S.F.

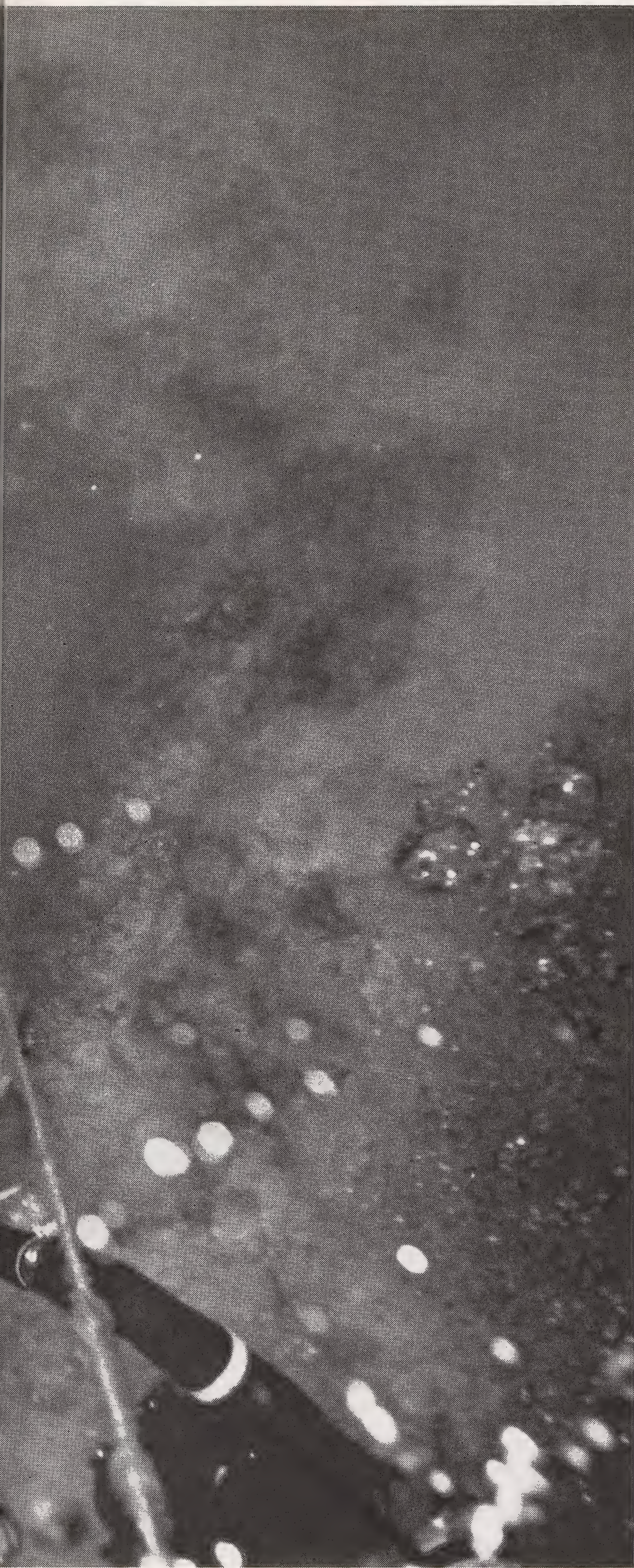
with a seal underwater. The first we saw of it was when it was above our heads, itself in *our* dive hole. Starting to surface to clear a line in which he was entangled, Lt. Lavallee found the seal filling our escape hole. It was a mature male of perhaps 800-1,000 pounds. In a few moments the seal sank slowly and went off, and Lt. Lavallee began to surface. But the seal had second thoughts and circled and returned. Within ten feet of me it descended just under my flippers, then rose and took a flipper in its mouth. Weddell Seals are gentle on land—I knew that—but what about them in the water? Was it a Weddell trait to defend its hole? I didn't know, but I did know that any haste on my part could be bettered by the seal, so I rose slowly through the slush ice in the hole until I bumped the still-surfacing Lavallee with my head. The seal still had my flipper in its mouth, but gently, not biting. As soon as Lavallee cleared the ladder, I rose to the surface. So did the seal. It came right up at my shoulder, eyes closed, nostrils intermittently opening and closing as it replenished





This picture was made underwater, at a depth of about 20 feet, and is looking up toward the

man-made hole in the ice. One of the problems of the study was how seals can find such



holes again after they dive, for they range far and must return unerringly in the darkness.

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A photographer was in the hut at the moment — described in the article — when Dr. Ray and Lt. Lavallee competed with a seal for use of their escape hole. The seal came up briefly to get a lungful of air and made no attempt to harm the divers; Dr. Ray even patted its head.

Photos by R. Lytell, courtesy N.S.F.

its air. I patted its head once, and scrambled out. It was, I think, the most satisfying experience of my life underwater. We saw several seals under the ice after that, but no others came so close.

How had this seal found our artificial hole? It was a hundred yards from another hole, also artificial, but a mile or more from the next nearest and several miles from the major portion of the herd. It is a question we can't answer yet.

As a result of this field work, we know the Weddell Seal a little better now and the Navy has helped us bring three of the animals to the Aquarium, where they are thriving. We learned a good deal about them in Antarctica and now, under controlled conditions, different techniques of study are being put to use.



What kind of maternal behavior to expect from a Giant Panda was, of course, unknown until observations were made on Li Li and offspring. Apparently she is a most affectionate mother.

Photographs from China Features

In the Peking Zoo — The First Baby Giant Panda

By OUYANG KAN, Chief feeder,
& TUNG SHU-HUA, Feeder

WHEN THE FIRST GIANT PANDA was brought out of China in 1936, it captured the heart of America instantly and completely. Many Members of the Zoological Society will remember our own engaging "Pandora," who was one of the stars of the former World's Fair. Subsequently we exhibited three more, one of which was in our collection for nearly ten years and was seen and enjoyed by millions of visitors.

Today there are only two Giant Pandas on exhibition outside the Peking Zoo — one in the Zoological Gardens of London and one in the Moscow Zoo. Some day, we hope, it will again be possible for a Giant Panda to enter this country. And, of course, that it will come to us!

Last fall we heard that a healthy male baby had been born to a female that has been in the Peking Zoo since 1957. Photographs and a short article about it have now been received by *Animal Kingdom* from a news agency in Peking.

AT DAWN on September 9, 1963, the Giant Panda Li Li gave birth to a 5-ounce male cub under our care in the Peking Zoo. This is the first Giant Panda born in captivity anywhere in the world. For the past five months both the mother and the baby have been in good health. The baby has grown from a creature as small as a mouse into the size of a little dog, weighing 21 pounds on January 28, 1964. The mother weighed 250 pounds.

The Giant Panda is one of the world's rare animals. Since the founding of New China in 1949 the Peking Zoo has had more than ten Giant Pandas but has only recently attempted to breed them. We have made an intensive study of the problems of breeding and the natural conditions in their habitat.

We named the new-born panda Ming Ming, meaning "brilliant" in Chinese. Li Li means "beautiful," while Pi Pi, the baby's father, means "mischievous."

For ten days Li Li was so attached to her baby that she carried him around all the time, even while eating. When the baby was two months old, Li Li would play with him by tossing him from one arm to the other. When Ming Ming grew impatient, she would soothe him with her paw just like a mother caressing her child.

At three months Ming Ming could manage to walk. The world was a novelty to him. He frequently wandered away from his mother during her nap.

Recently Ming Ming has started playing alone outside his room. He wanders in the enclosure, nuzzling anything that comes in his way. He

Ming Ming weighed only 5 ounces at birth but he gained weight rapidly and at three months weighed 5.7 kilograms, or about 12½ pounds.





forgets to return until his mother brings him back.

In the morning Li Li's first job is to nurse Ming Ming. Her favorite food is bamboo leaves, but Ming Ming is still too young for such a meal, which requires strong teeth.

At times Li Li welcomes visitors with outstretched neck. At others she hugs Ming Ming in her arms and turns her back on the visitors.

Since his birth Ming Ming has gained weight quickly. He shrieks at anything that seems threatening and is responsive to sound. If we call out his name two metres away, he never fails to turn back and come to us. We try to keep him in the sunshine and comb his hair regularly to keep him in good health.

In the Peking Zoo the Giant Pandas are fed three times a day. Apart from bamboo leaves and shoots, they are given milk, sweetened gruel, eggs and biscuits. During meals they are very good-natured and tractable; at other times they are generally playful, but in a capricious mood they may try to bite, or hug our leg in a painful grip.

The Giant Panda is sometimes called the

Ming Ming was two months old when this picture was taken, and his mother was still carrying him everywhere; he walked at 3 months.

parti-colored bear. The head and body are white, the legs and ears black, there is a black stripe on the shoulder and a patch of the same color over each eye. It is considered one of the most primitive types of mammals still extant.

The animal is found only in the mountains between 9,000 and 13,000 feet above sea level in the western part of Szechuan province in Southwest China. In winter the animal hollows out an earthen cave near a tree. In summer it moves to ground covered with moss and grass. It dislikes heat.

The mammal is so rare that one specimen was valued before World War II at about 15,000 U. S. dollars — approximately the price of 30 lions. In the 20 years before the founding of the People's Republic only 14 Giant Pandas are known to have been captured. All those taken to the United States and Britain died subsequently.

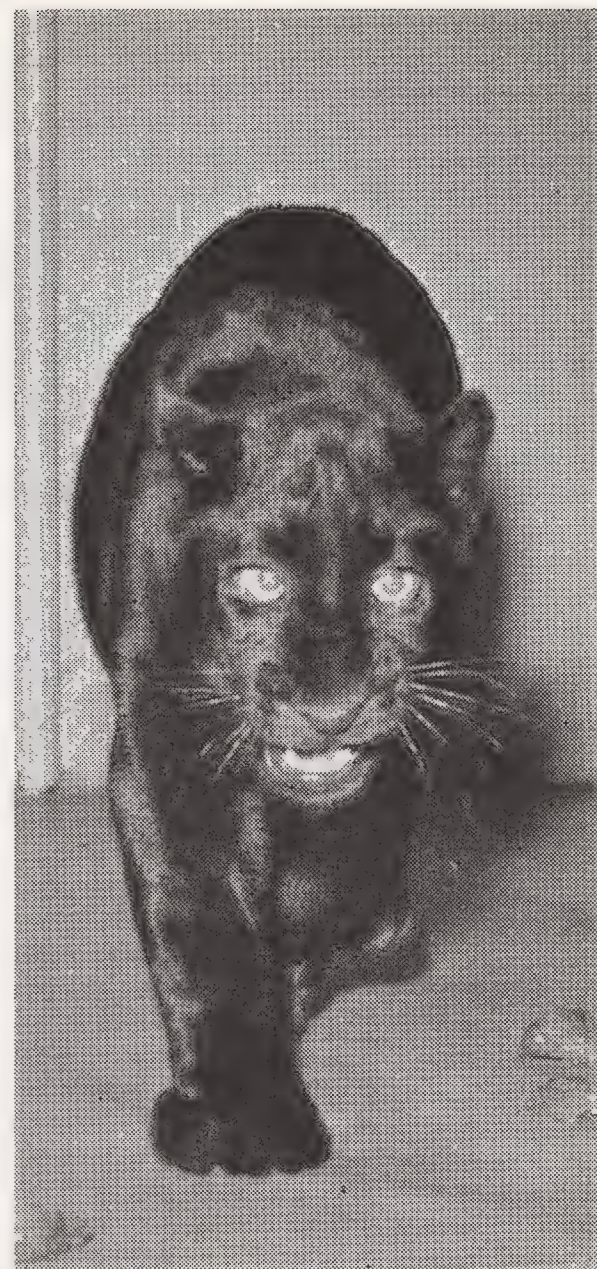
ZOO NEWS IN PICTURES

BY SAM DUNTON

Staff Photographer

This lovely young Black Leopard was born June 28 of last year in the National Zoo and has come to us as a prospective mate for an African Spotted Leopard one day older. Kept in the same compartment in the Lion House in daytime, they ignore each other — the male Spotted stays on a ledge and the female on the floor, seldom trying to jump.

Delightfully tame so far (as he grows older he is likely to become untrustworthy), this young Indian Leopard has taken a great liking for his keeper, Fred Martini. They often play together.





Lesser Green Broadbills (*Calyptomena viridis*) are among the world's most beautiful birds — iridescent green and sparkling black. There are 14 species in the Family Eurylaimidae and these are the first we have ever exhibited.



When we received 5 Impalas last fall we hoped for a series of births but scarcely expected one so soon. Apparently one female was bred before she came to us; this baby was born Feb. 18 in the old Yak House winter quarters.

A Gemsbok has small button horns at birth, and they grow rapidly; at the age of about 7 weeks, this youngster has sizeable horns — and he knows how to use them. He demonstrated his aggressiveness against his keeper when only a few days old. Two young have been born in the Antelope House and are now on exhibit in company with their mother.



Winter babies among outdoor herds of tropical animals frequently have a hard time surviving. These are two we had to rescue and rear by hand — a spotted Axis Deer fawn and a chunky little Mouflon. They will be in the Children's Zoo during the spring months.

Two young White-backed Night Herons — the first we have ever exhibited — have come to us from Liberia. Little is known about them in the wild, but they seem to be the jungle counterpart of the familiar Black-crowned Night Heron of this area. Both of the newcomers are still gawky, not yet in adult plumage.





Dedication of the Charles Darwin Research Station

THE CHARLES DARWIN Research Station on Santa Cruz (= Indefatigable) in the Galapagos Archipelago received its official benediction on January 22. Although the Station has been in partial operation for several years and has aided the studies of several scientists (including the New York Zoological Society's 1962 expedition), the dedication ceremony marked the end of its constructional stage and a beginning of greater emphasis on its research and conservation efforts.

More than a hundred persons gathered in the blazing tropical sunshine for the dedication and all bore marks of the sun's un-temperate activity

Sr. Acosta-Solis, president of the Society of Natural History of Ecuador, is speaking at the dedication ceremony. Behind him are Sr. Armando Pesantes, Col. Freile, General Gandara and Dr. Van Straelen, Foundation President. (Dr. Van Straelen later died in Ecuador).

Photo by David Pearlman, San Francisco Chronicle

before it ended. I attended as the representative of the Zoological Society. Prominent among the speakers were two members of the ruling military junta of Ecuador, General Marcos Gandara and Colonel Guillermo Freile. Their presence and that of many other important members of the Ecuadorian Government emphasizes the interest of that country in the Galapagos Islands. It is to be hoped that it also presages an era of close cooperation between the government of Ecuador and organizations hopeful of conserving the unique flora and fauna of these islands. Another welcome sign of cooperation was the warm greeting by Capitán Alvarez, the Commandante of the naval district that includes the Galapagos.

An unusual note was provided by a greeting from Captain Thomas Barlow, great-grandson of Charles Darwin. True to his heritage, he proved

to be an avid field naturalist and enjoyed himself hugely during his Galapagos visit as he became acquainted with the animal life that his illustrious ancestor had made so famous.

Correlated with the official opening of the Darwin Station was the arrival of the Galapagos International Scientific Project, a party of between fifty and sixty scientists sponsored by the University of California and the National Science Foundation. Including geologists and meteorologists as well as biologists of many different fields, the party spent five weeks studying many aspects of the islands and their plant and animal life. This is perhaps the largest group of biological scientists ever to attempt simultaneous study of such a small land mass, but most of them found that the time was far too short. Many are already laying plans to return.

The major construction of the Darwin Station is now completed and the Director plans now to concentrate on the difficult and serious business

of conserving the many threatened plants and animal species.

The laboratory building has the beginnings of a comprehensive library of books and papers pertaining to the islands and a cross-indexed file of recent observations on the animal life has been established. Electricity (110 volts) is available at the Station from a pair of Diesel generators and both brackish and fresh (rain) water are available, although the latter is still in short supply. The residence of the Director, a storehouse, a shop, four aviaries and three tortoise yards have been completed. A seismographic station and a weather station are under construction. With help from the U. S. National Science Foundation, dormitory facilities for more than twenty scientists have been provided. The *Beagle*, a motor-sailing boat 47 feet long that will accommodate six researchers, was due at Santa Cruz in late March and will be available for transportation to other islands of the archipelago. — H. G. D.

Goats and Hawks — A New Theory of Predation on the Land Iguana

By HERNDON G. DOWLING

Curator of Reptiles

THE LAND IGUANAS of the Galapagos Islands are not the huge dragons that popular literature would suggest but they are, nevertheless, important and striking members of that unique reptilian fauna. With knobbed heads and stoutly built bodies, they range from two to four feet in adult size and give a distinctly Mesozoic aspect to the rugged terrain they inhabit.

Two species of these large terrestrial lizards are found in this archipelago. The "central islands" of Fernandina, Isabela and Santiago, and Santa Cruz with its associated islets of Seymour, Baltra and South Plaza are (or were) inhabited by the typical species, *Conolophus subcristatus*. At some seasons of the year, presumably the breeding season, the males of this species assume brilliant

colors — a back of coppery-red, a sulfur-yellow head, legs with touches of this same color and around the neck a white collar. Barrington Island, some fifteen miles south of Santa Cruz, is inhabited by its own species of Land Iguana, *Conolophus pallidus*. Unlike the other species, the Barrington iguana does not assume brilliant colors but remains a yellowish-tan hue throughout the year.

Like the other terrestrial reptiles of the Galapagos, the Land Iguanas are unique and nothing quite like them is known from any other part of the globe. True, "Land Iguanas" of a somewhat different sort (*Cyclura*) are found in the West Indies and some biologists have suggested that the iguanas of the Galapagos (as well as the

tortoises) were derived from West Indian species which had drifted by some extinct ocean current through the "Panama Portal" in a pre-Pleistocene era. However, Dr. Richard Etheridge, a student of iguana-lizard relationships, believes that the Galapagos iguanas, both land and marine, were descended from some unfortunate arboreal iguana (*Iguana iguana*) that was washed or blown from the adjacent South American mainland into the coastal Humboldt Current that sweeps westward to these desolate islands.

Although they are not as remarkable, perhaps, as the giant tortoises that gave the islands their name (*galápagos* is Spanish for tortoise), they were mentioned by Fray Tomas de Berlanga, who discovered the islands in 1535. A little later iguana tail (Land Iguana, because Marine Iguanas are not considered fit to eat) became a staple item in the diet of visiting buccaneers. One of them, Ambrose Cowley, wrote thus about them in his diary of June, 1684, "Guanoes are as plenty there as in any place of the world and extraordinary sweet meate. . ."

The buccaneers alternated iguana meat with their favored breast of tortoise during most of the seventeenth century and well into the eighteenth. They were followed in the eighteenth century by whalers who equally appreciated the flavor of iguana flesh, as did and do the tortoise-hunters and colonists who followed them. Thousands of iguanas, perhaps tens of thousands, fell to this direct human predation but, so far as can be determined, this was not responsible for the loss of a single iguana population.

As a matter of fact, Charles Darwin, who in 1835 visited Santiago (= James) Island, which had been a favored port-of-call for the ships of buccaneers and whalers, found Land Iguanas exceedingly numerous. He wrote, "we could not for some time find a spot free from their burrows on which to pitch our single tent." Yet only a few years later they had vanished completely.

What were the causes of the disappearance of the Land Iguanas from Santiago? What made them disappear from Baltra in 1942? And why are they now disappearing from Santa Cruz? These were questions that occupied our thoughts in the New York Zoological Society's expedition to the islands in 1962 as well as during my second visit in 1964. This second visit was in connection with the dedication of the Darwin Research

Station, from which I returned at the end of February.

Land Iguanas were said to be "very numerous" on two islands and in 1962 we determined to visit them both. Karl Angermeyer, a resident of the islands since the late 'thirties, took us first to South Plaza.

This small islet, hardly more than a rock a few hundred yards off the east coast of Santa Cruz, is about 600 yards long and 100 to 200 yards wide. Its lava-rock base, cactus-studded terrain and tangles of spiny brush are identical with the shore of the adjacent mainland.

Here lived a thriving colony of Land Iguanas and yet, on the mainland, there were none — the nearest surviving colony was some twenty-five miles away on the opposite coast. Obviously, those few hundred yards of water made the difference. They meant that South Plaza had no introduced mammalian life while Santa Cruz had donkeys and goats, cattle and pigs, dogs, cats, Norway rats and house mice. All of these had been introduced by man, either purposefully or accidentally, and all had "gone wild," taken up a feral existence on this previously reptile-dominated landscape. One of these, or perhaps a combination of several, was making life impossible for iguanas on Santa Cruz. But which one could it be?

A closer look at the Plazas iguanas showed that the population was actually quite small — perhaps 200 individuals. Small perhaps, but there was no question of its virility. Most of the population was made up of subadult lizards, ranging from the foot-long young-of-the-year through various age classes to the adult size. The adults were by far the most conspicuous, since they were often seen in the open, basking contentedly on a projecting boulder of lava or spraddled in the shade of an overhanging *Opuntia* cactus. The youngsters behaved differently. They seemed always to be in the midst of some briary tangle or scuttling inconspicuously alongside some fallen cactus stem. None of the adults seemed to be as large as William Beebe and others had described and I asked Karl about this. He said that when he and his brothers first visited the island in the late 'thirties, the iguanas were as big here as elsewhere. As more and more fishermen came to the Galapagos and stopped for an iguana-tail meal, the really large adults disappeared but the



number of lizards remained about the same. Plaza, then, is a show-case of the effect of direct human predation on Land Iguanas.

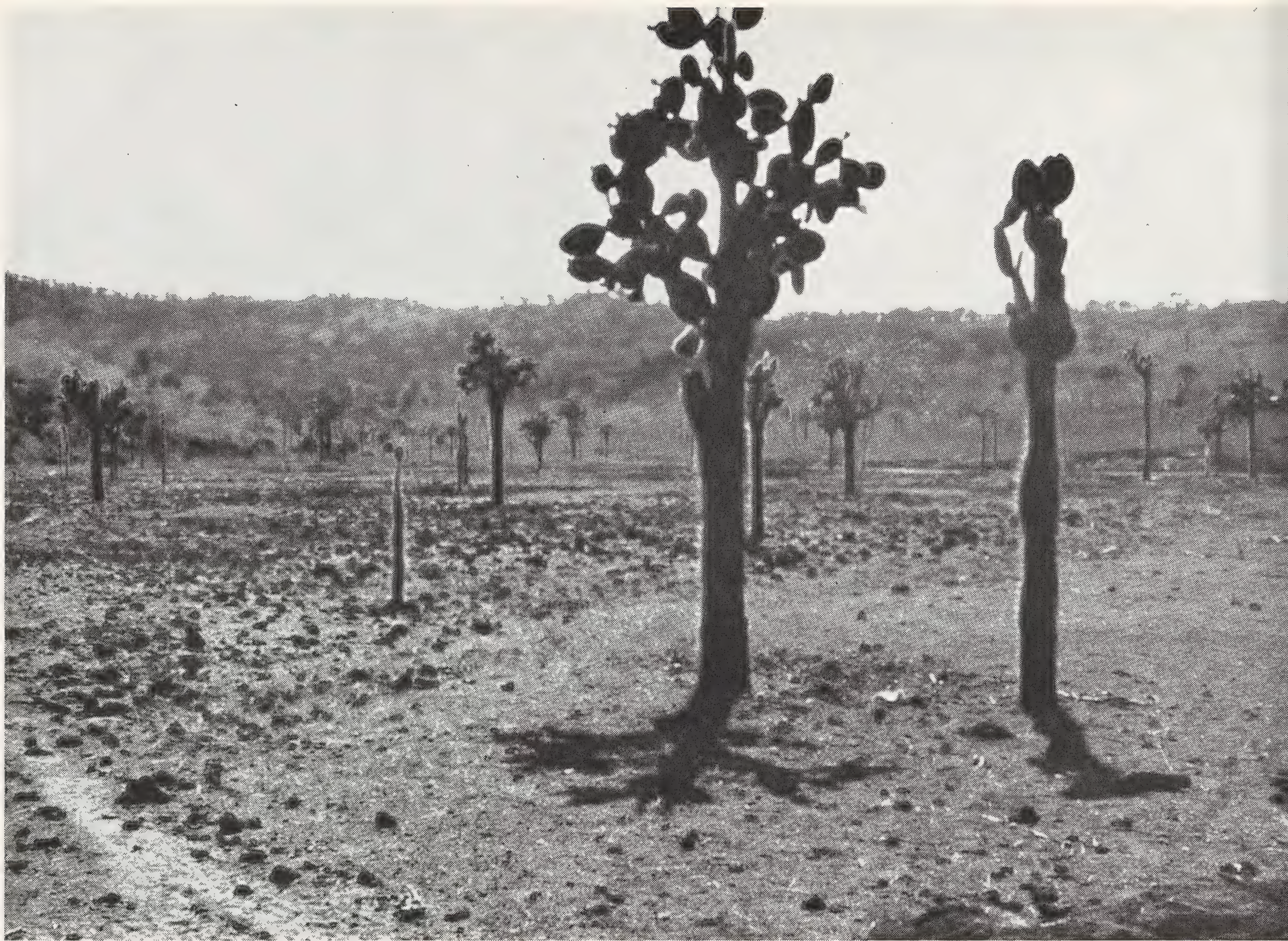
No one had prepared us for the contrast between the iguanas of South Plaza and those of goat-infested Barrington Island, where we next met Land Iguanas. Barrington Island is perhaps five miles long and one or two miles wide. Like most of the Galapagos, it has exceedingly rough terrain and is without fresh water. We went there on Miguel Castro's boat and he told us just where we could go to see the main iguana colony. Our informants had merely said that Land Iguanas were common here, as they were on Plaza. This was true, but with what a difference! The Barrington iguanas were all large, old adults. In our brief visit we saw about thirty adult iguanas but not a single juvenile. Dr. Charles Carpenter and his party in 1962, in a longer stay, found a lone youngster among many adults and this year (in 1964) a University of California field party saw one foot-long individual, two of about eighteen inches, and some forty or more adults. There was no reason to suppose that more young were present but not seen. They were visible enough on South Plaza.

Young Land Iguanas are comparatively abundant on Plaza, where there are no introduced predators and the rough terrain — lava and thorny bushes — is a normal iguana habitat.

Photos by the author unless otherwise credited.

Obviously, a population made up of adult animals only cannot survive. In thinking about the Barrington situation, I had the nagging thought that something about the extinction of iguanas on Baltra was similar to this. The establishment of the United States military base on Baltra in 1941 had always been given the blame for the iguanas' disappearance, but was it really this? In following up this thought, I began to re-read William Beebe's account in "Galapagos: World's End" of the Land Iguanas on Baltra (= South Seymour) in 1923. I had skimmed several pages when I came to the paragraph that had lingered, vaguely, in my memory.

"Every cactus, every small isolated bush of *Cordia* or *Acacia* or *Bursera* sheltered a lizard, and all big ones," he wrote. "Throughout all of our explorations of this colony I saw *not a single lizard under twenty-four inches and most were three feet and even more in length.*" (Italics mine.)



Baltra, then, had a dying population of Land Iguanas in 1923. In confirmation of this, Dr. Loren Woods of the Chicago Natural History Museum later told me that when he visited Baltra in 1940, prior to the establishment of the military base, he found only a very few Land Iguanas — *all of them large adults*. Thus, the American base may have exterminated the Land Iguana population of this island, but only a few adults remained at that time to be exterminated. It had already been pushed to near that point by other factors.

Goat-infested Barrington Island is an extreme contrast to Plaza. Here the natural cover has been stripped bare and young Land Iguanas cannot survive. The goats are to be shot off.

Photo by R. S. Chase

A census of the Land Iguana populations of the Galapagos demonstrates that only the populations of Fernandina occur in their original high numbers. The reports of Dr. J. R. Hendrickson and his associates who visited the southern slopes of this island in 1964 are highly reminiscent of Darwin's remarks about the iguanas on Santiago

LAND IGUANAS IN THE GALAPAGOS ISLANDS

Island	Exotic Animals	Status of Iguana
Fernandina	None	Original high numbers
Isabela	Goats, donkeys, cattle, pigs, dogs, cats, rats	Unknown ¹
Santiago	Goats, donkeys, pigs	EXTINCT ²
Seymour	Goats (rats?)	Few, large adults
Baltra	Goats, rats (mice?)	EXTINCT
Santa Cruz	Goats, donkeys, cattle, pigs, dogs, cats, rats, mice	Few, large adults
South Plaza	None	Small thriving colony
Barrington	Goats	Many large adults, few young

¹ Some adults seen on northern coast where only cats, among exotic animals, have penetrated the lava flows. Numbers of northern populations unknown and status of southern populations completely unknown.

² Unconfirmed recent report by a native worker of Land Iguanas in eastern highlands.

in 1835. Fernandina is the only large island of the Galapagos that still has only its original animal life and, of the smaller islets that have iguana colonies, only South Plaza lacks "exotic" animals.

On South Plaza man, himself, has acted as the sole predator on Land Iguanas and the lizard population of this island shows what happens in this case — the large individuals are killed off but reproduction in the colony continues at a high rate. The history of Baltra and the present situations on Barrington, in the few remaining colonies in isolated spots on Santa Cruz, and in a recently-discovered colony on ("North") Seymour show the effects of some other condition — one that reduces the reproduction of the iguanas, leaving populations of old adult individuals. Obviously, some other animal of the introduced "exotic" fauna must be responsible for the decline and ultimate extinction of these populations.

The exotic faunas of Santiago, where the Land Iguanas have become extinct, and of Santa Cruz, where they are almost so, are so large that it would be difficult to say which animal or which combination of animals might be responsible for the decline of the iguana populations. However, on Baltra there were only goats, rats (Norway) and perhaps house mice. And on Barrington there is only one — the goat. It is notable, too, that all of the islands that have lost their Land Iguanas, or are apparently in process of losing them, have goats as one of the introduced species. And it should not be overlooked that Santiago (= James), which lost its iguanas first, was also the first island to have goats introduced on it (from an accidental release by Captain David Porter, U.S.N., in 1813).

Goats are not known to be iguana-killers, however, in the way that Virginia Deer are rattlesnake-killers. Nor did it seem likely that more competition for the critical food item, the *Opuntia* cactus, would account for the iguanas' disappearance. And why the young? The young are much more able to climb onto the cactus plants and feed there than are the adults.

This was the stage of my thoughts when I left the Galapagos in 1962. Obviously, there was some factor correlated with the presence of the goats, perhaps some actual predator, that was finally responsible for the disappearance of the young iguanas. My first idea was that perhaps the combination of goats and rats gave this result



Now the Galapagos Hawk has been identified as one of the predators on young Marine Iguanas. Hawks could easily catch and carry off young Land Iguanas on barren islands.

— the rats eating the eggs of the iguanas when the plant food became scanty. This was easy enough to visualize when the rat was the imported Norway species, but a little less likely when related to the native species found on Barrington.

On Santiago Island and on Barrington the goat populations had become so large that during the dry season (which includes about nine months in the year) they eat practically all of the vegetation that can be reached. On Barrington

Large and old Land Iguanas such as this one Dr. Dowling is holding are typical of Barrington — in fact, not a single young lizard was seen on that island on Dr. Dowling's latest visit. The goat-extermination campaign of the Darwin Research Station will begin on Barrington Island soon.



ton, particularly, the goats had cleared out all of the original brushy undergrowth and had eaten back the larger bushes, trees and cacti to give the vegetation of the island a trimmed and park-like aspect. (This is also seen on the plateau above James Bay on Santiago).

Such a situation obviously offers a possible predator on young iguanas a much better chance to catch them. They are fully exposed to view and unable to seek the shelter of the normal brushy tangles they inhabit. Lava Gulls (which have been seen to pick up the smaller, newly-hatched Marine Iguanas), the diurnal Short-eared Owl and the Galapagos Hawk were possible predators of these lizards. None had ever been seen preying on lizards of the foot-long dimensions of young Land Iguanas, however.

My 1964 visit changed my thinking. In early February a part of the California Galapagos Expedition was camped on Punta Espinosa, Fernandina, observing the much-publicized colony of Marine Iguanas on the point when a Galapagos Hawk flew down and sat on the rock among the iguanas. After looking around for a while it dove

into a crevice and flew off with a Marine Iguana about eighteen inches long, which it proceeded to eat. Subsequent examination of the nest of this hawk revealed the remains of several other Marine Iguanas.

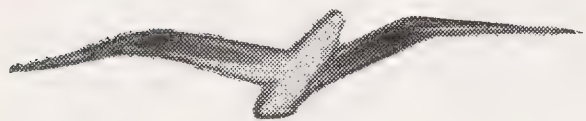
This observation, for the first time demonstrated that the Galapagos Hawk was a lizard eater, like its mainland relatives, and that it could catch and carry a lizard in the size range of juvenile Land Iguanas. Hawks are especially common on Santiago and Barrington Islands and thus are able to be a major menace to the goat-exposed iguana young. While only a study of the hawks of Barrington Island can test the validity of this idea, I am convinced that the goat-hawk combination is the explanation of Land Iguana disappearance.

At last we have a clue of the actual interrelations that must be countered to save the Land Iguanas that remain. Dr. David Snow, Director of the Darwin Research Station in the Galapagos, has told me that goat control on Barrington Island will be the first major conservation effort in the archipelago. May it be a success!

Our Resident



Red-tailed Hawk



By **JOSEPH BELL**

*Assistant Curator of Birds
Illustrations by the author*

HERRING GULLS wheel in lazy flight above the Sea Lion Pool, drifting indolently yet watchful lest they miss a free meal at feeding time below. It is a familiar sight in the Zoological Park — but look again! One of those aerial performers is quite different from its gliding companions. Like them, it has long wings, but much broader and flatter, without the typical downward crook of a gull's wings. As it soars, it flirts its broad, rounded tail like a Victorian lady using a fan and the feathers glint rusty-red when the sun strikes them as the bird turns and climbs.

The gulls are completely indifferent to their companion as he matches their mastery of the air currents, turn for turn, with an economy of wing beats.

Now we see him again, headed west over Baird Court, but not in the same leisurely pattern of flight; this time he is pumping for all he is worth, with a dozen jet-black birds in hot and noisy pursuit, close upon his tail. Crows are not as tolerant as gulls.

These brief vignettes introduce a Red-tailed Hawk — to be more precise, *our* Red-tailed Hawk, resident in the Zoological Park by his own choice. We have, of course, many other avian guests living here on the same basis. Pigeons, Starlings, Mallards and Black Ducks are among them. But

the gulls are the most assiduous foragers; they keep abreast of all our feeding schedules and at meal time they are on the spot, right on time, ready to steal a fish or anything else we offer our own animals, and that a gull considers edible — which is to say, about everything except hay.

A small group of Black-crowned Night Herons, sitting hunched and silent, but vigilant, in an oak tree outside the northeast corner of the Large Flying Cage, meet their daily food requirements in much the same way.

Although on occasion he flies with the gulls, the Red-tail is no mere free-loader; he makes his living in a different way. You might even say he more than earns his keep, for he feeds chiefly upon the many small rodents attracted by our animals' food. He is indeed a sort of volunteer worker in our campaign against the rats and mice that are a constant expense to our food budget.

Our resident Red-tail is a member of a group called Buteos or soaring hawks. There are more

than seventy species and subspecies dispersed over most of the earth's surface, but this species, *Buteo jamaicensis*, is North America's best known and most widely distributed bird of prey.

Chicken Hawk, Hen Hawk and Buzzard are some of the unfortunate colloquial names applied to the Red-tail — unfortunate because they reinforce its undeserved reputation as a noxious species, a threat to wild game birds or to anyone with poultry running in his yard or on his farm. Hawks of every kind, for that matter, have been considered vermin and shot whenever and wherever they came within range. It is notorious that in some places hunters used to station themselves along known flyways during hawk migrations and slaughter anything that flew past. This feeling still persists about predatory birds, even though many states now have laws protecting hawks.

For many years biologists and ecologists have been aware of the true picture of the Red-tail and his relationship to other birds and mammals in his environment. Before the turn of the present century, research by Dr. A. K. Fisher ("The Hawks and Owls of the United States in Relationship to Agriculture," 1893) showed that less than ten percent of the Red-tail diet is made up of poultry or game birds. Mice are the principal item on his menu but squirrels, gophers, rabbits, shrews, voles, weasels, porcupines, chipmunks, muskrats and skunks are some of the others that help to round out his yearly bill of fare.



It is evident from this list that Red-tails take most of their quarry on the ground. While they are graceful in flight, they are not swift enough to take their prey on the wing in the dashing manner of their relatives, the falcons, and so they have never been sought after by falconers to be trained to hunt for man. Nonetheless, for their own purposes they are impressive hunters, as anyone who has watched them will agree. Soaring several hundred feet above the forest or the open fields, a Red-tail appears to come to a dead stop in mid-air. Train your binoculars on him and you will see that he is hovering on his strong, broad wings, pointing his head straight down at right angles to his body. He searches the area below him, seemingly inch by inch, and may keep this up for a full minute or more. Then he closes his wings and drops in a breathtaking dive, very often disappearing into the treetops below without checking his speed.

During autumn migration, flights of hawks may be seen traveling together above the ridges of a mountain chain, riding the warm air currents rising from the valley floor and sweeping upward along the slopes. The Red-tail's broad wing surface gives him a great advantage over smaller birds as he hitch-hikes along these highways in the sky, a free-ride passenger on rising air thermals.

Food supply and weather conditions are strong factors in Red-tail migrations. Sometimes a single bird or a pair may be seen in one area all year long. Our resident hawk has been observed on, or over, the Zoological Park grounds for several years and has never strayed very far or for very long. A second bird, a immature with a brown-barred tail, has recently been seen soaring and hunting the back woodlands of the park in company with our bachelor. Red-tails are known to form lifetime partnerships, only choosing a new mate upon death of one of the pair, and this may be the beginning of such an association.

We enjoy watching the daily sallies of one or both of these birds. Sometimes we see them just drifting across the sky or again we surprise one of them just after a kill, when he takes wing in labored flight, clutching his prey in his strong talons.

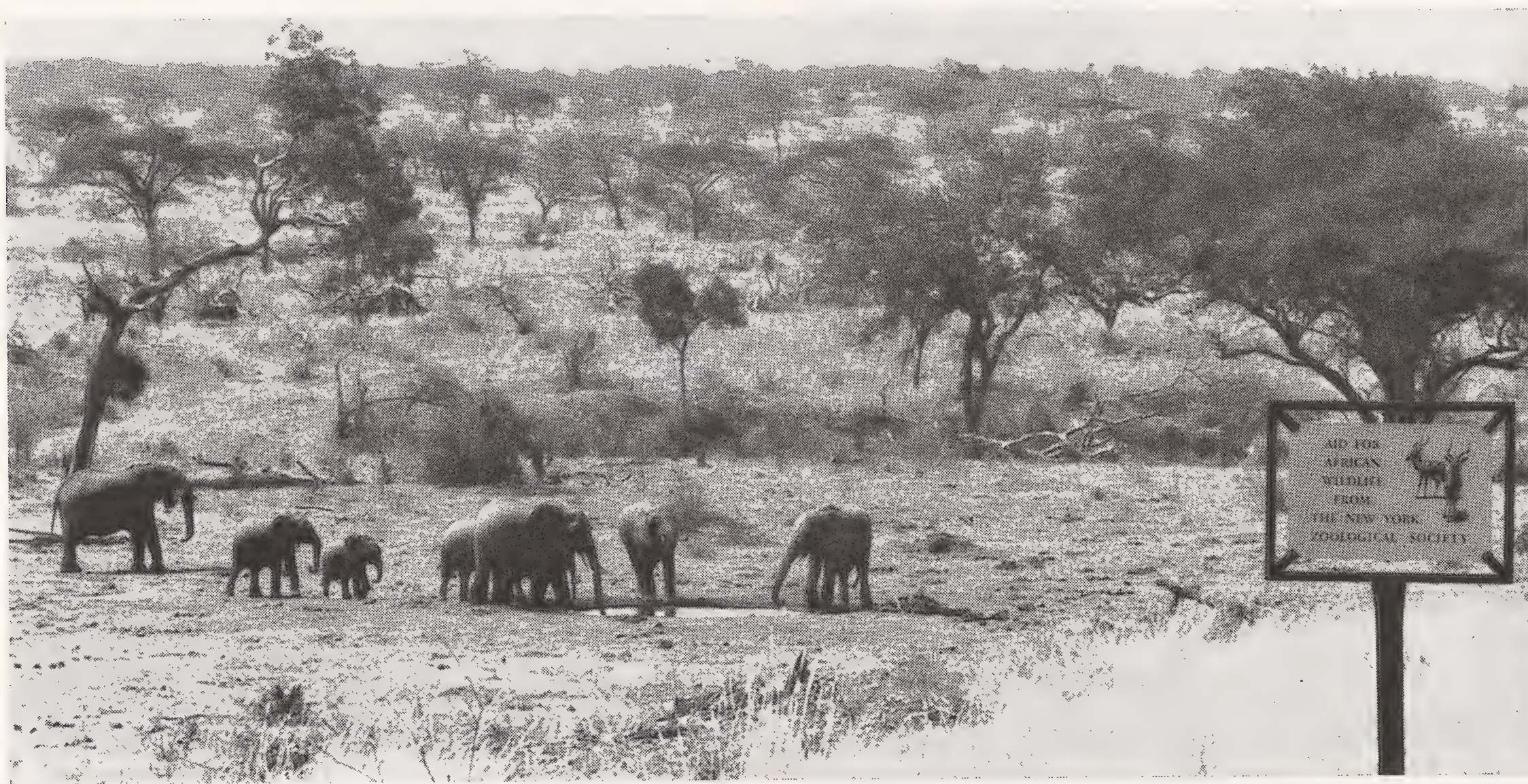
We watch them and we worry just a little. Suppose they should decide to vary their diet with a nice duck dinner? But to me, part of the

charm of any predator lies in the fact that he can be dangerous.

On a recent mild winter day I watched one of our Red-tails as he sat on a snag limb high up in a sweet gum that overlooks the African Plains and the Antelope ranges beyond. He seemed lazily content to sit and preen in the sun. But his toilet was short and skimpy, for a flock of Starlings

discovered him within a few minutes. With more courage than wisdom, they dived upon him, one after another, until they forced him to leave his peaceful perch. When last I saw him, he was easting for the woods along the Bronx River with a squadron of righteous Starlings behind him. It was the ancient turn-about lesson in natural history; the hunter was being hunted.

Waterholes for African Wildlife



IN THE July-August issue of *Animal Kingdom* last year, Royal Little described a visit he had made to the Tsavo National Park in Kenya and mentioned the financial aid the Zoological Society has given, through its African Wild Life Fund, for the creation of waterholes for wild animals in drought-stricken areas.

To identify the Society's participation in the water-for-animals work, signs on anodized aluminum have been set up at the waterholes — and so far seem to have escaped being pushed over by the animals!

The photograph reproduced above has been sent to Mr. Little by Tuffy Marshall, Chief

Warden of Tsavo West. It shows, he wrote, "elephants drinking at your first borehole, at the head of Rhino Valley. It does not show the large herds of seventy to eighty elephant which were using it during the dry weather."

He mentioned that some of the photographs he sent Mr. Little plainly showed how the area around the drinking trough has been trampled down by game coming to the water.

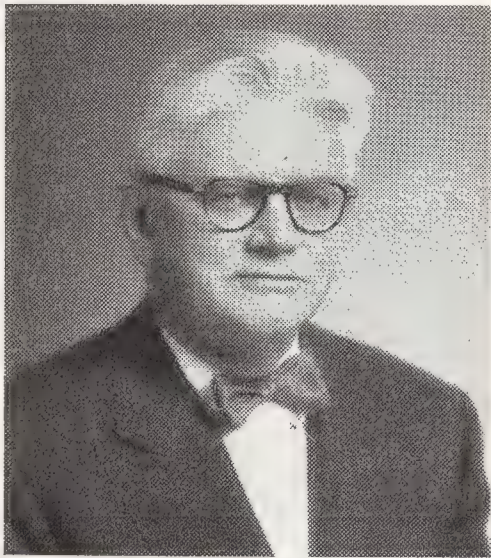
Each of the waterholes consists of a well, some as much as 300 feet deep, a pump driven by a diesel engine, a large storage tank and an automatic gravity feed to a concrete drinking pool. A great variety of animals use the holes.

News from the Conservation Foundation

William Vogt, D. Sc.

With considerable pleasure, the Foundation announces the appointment of Dr. William Vogt as its Secretary, replacing Stephen W. Blodgett who was recently elected to the Board of Trustees.

As a Fellow and a long-time Member of the Zoological Society, Dr. Vogt scarcely needs an introduction to readers of *Animal Kingdom*, but for the record let it be stated that



his career may be divided into three parts, each culminating in the publication of a significant and successful book. Early experience as an ornithologist, curator of the Jones Beach Bird Sanctuary and field director and lecturer for the National Audubon Society as well as editor of *Bird Lore* (now the *Audubon Magazine*) led inevitably to his participation in the publication of "The Audubon Birds of America."

Service with the War Department and as Chief of the Conservation Section of the Pan-American Union led with equal logic to the publication of "El Hombre y la Tierra" and "Road to Survival." The former, published in three countries, has recently been reprinted at the request of the Peace Corps for field distribution. The latter, a "Book of the Month," published in nine countries and regarded as his most important book, has been accepted and recognized for many years as an important text in social and natural science curriculums.

Recently Dr. Vogt, as National Director of the Planned Parenthood Federation of America and a member of its national board of directors visited Bombay, New Delhi, Stockholm, Rome and Tokyo, and out of his travels and study of the exploding world population came the book "People!" published by Sloane Associates in 1960.

Soon after his appointment to the staff of the Foundation, Dr. Vogt made a survey trip through Mexico, El Salvador, Guatemala and Costa Rica

to prepare a report on the conservation needs of these countries and the opportunities for private philanthropic projects.

Within the next year he expects to find time for visits to Colombia and Venezuela. Peripatetic, pervasive and persuasive, Dr. Vogt is a most welcome addition to the staff.

American Film Festival

Associate Justice William O. Douglas of the Supreme Court will be the principal speaker at Conservation Night of the American Film Festival at the Biltmore Hotel in New York on April 30.

The Festival, sponsored by the Educational Film Library Association, has been a major spring activity in the educational films field for the past five years. Entries of conservation films have increased to such a point that a separate category became necessary. To emphasize the importance of 16 mm. films in conservation ideas and to honor filmmakers in that field, Conservation Night has been planned under joint sponsorship by the Festival and the Foundation.

Briefly Noted

Samuel H. Ordway, Jr., will take part in a panel program of the American Society of Public Administrators on April 19, during its national conference on Public Administration. . . . Dr. F. Fraser Darling returned to this country the first three weeks in March and with Noel Eichhorn continued a survey of National Parks with a visit to the Everglades National Park in Florida. With John Milton he is making plans for next year's North American Wildlife Habitats Study Conference. . . . Dr. Vogt attended the meeting of the Latin American Committee on National Parks at Guayaquil March 1-4. . . . Oscar Godbout, in a *New York Times* review of the Foundation's film, "The Pond and the City," commented: "Now I have seen . . . a film of top quality devoted simply to the message of conservation of our land and the beauty it represents."

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

Society to Be on Television at the World's Fair

The Zoological Society will present a weekly half-hour television show in color at the World's Fair, over a closed-circuit network of some 300 color receivers throughout the Fair grounds. The shows will originate in the exhibit building of the Radio Corporation of America, which contains a complete color television studio. Miss Phyllis Linnemann and Miss Michele Perrault of our Education Department will present the show "live" in the studio, in two 15-minute segments, one day a week. It will be taped and re-shown at intervals on the other days of the week. Visitors to the RCA Building will be able to watch the show as it is originally given and on many occasions children from the audience will participate. About a score of small, easy-to-handle animals will be used, many of them animals the two girls from the Education Department regularly use in schoolroom demonstrations around the City.

Aquarium Team Collects in Bimini Waters

A collecting team under the direction of Dr. Ross F. Nigrelli, the Aquarium's Director of Research and Pathologist, made a collecting trip to Bimini in March. Based at the Lerner Marine Laboratory of the American Museum of Natural History, the collectors sought sponges, toxins from boxfishes, sea cucumbers and other invertebrates, brains of sharks and other elasmobranchs for analysis of new biochemical substances, and a series of Slippery Dicks afflicted with papillomas, for electromicroscopical studies.

Besides Dr. Nigrelli the party included Dr. Martin F. Stempien, Jr., of the Aquarium staff, Dr. Gustavo Pulitzer, a marine ecologist and poriferologist of Portofino, Italy, and Dr. L. Edgar Lee of the Yale University Medical School.

Drs. Nigrelli, Stempien and Pulitzer were highly successful with their sponge collection, some 35 species being taken — some of them

probably new. Dr. Pulitzer helped to clear up an important point concerning the ecology of the sponge *Cryptotethya crypta*. Lacking ribonucleic acid (RNA), it has been suggested that this sponge probably lives under anaerobic conditions deep under the sand and without free oxygen. A dive into the deeper water on the Gulf Stream side of Bimini showed that the sponges were loosely attached to the surface of rocky shelves and only lightly covered with coral sand.

New Folders About the Zoo and the Aquarium

Bound into this issue of *Animal Kingdom* are two new folders about the Zoological Park and the Aquarium, intended for distribution to prospective visitors. Many thousands of them will be distributed at the New York City Building at the World's Fair where the Zoo and the Aquarium, like other cultural institutions of the City, will be represented by large display panels. The folders — as well as the display panels — were designed by Mrs. Dorothy Reville of the Publications Department.

The folders may be removed from the center of this issue and it is hoped they will be useful in guiding more of our Members to the Zoo and the Aquarium.

Harp Seals Are Captured for the Aquarium

Curator Paul Montreuil of the Aquarium returned from Magdalen Island in the St. Lawrence in mid-March with an adult male, an adult female and four pups of the Harp Seal for exhibition. He had hoped to capture Hood Seals as well, but none were seen, except one male which severely injured a young boy and was killed by the boy's father. The pups that came to us were still in their white babyhood coat.

Aircraft, both helicopters and fixed wing craft, are increasingly widely used in sealing operations in Canadian waters. Mr. Montreuil made a heli-

copter flight with a team from the Fisheries Research Board of Canada to observe tagging of Harp Seals, whose survival under intensive hunting is a cause for concern.

Dr. Ray in Bahamas

Dr. Carleton Ray of the Aquarium staff spent March in the Bahamas where he checked the Green Turtle transplantation program in Inagua — a joint conservation measure of the Bahamian National Trust and the Caribbean Conservation Corporation — and visited the flamingo colony on the island. He made a small collection of fishes and invertebrates for the Aquarium, including brittle starfish, several species of sea urchins, among them the long-spined and venomous *Diadema*, a small tidepool octopus and a sea hare.

IN BRIEF

Spring Openings. With the reopening of the Children's Zoo for its 24th season on March 28, spring officially came to the Zoological Park. The Animal Nursery — instituted two years ago as a part of the Children's Zoo — was reopened at the same time. All the Park's summer services are now in regular operation except the Tiger Trains (lecture tours of the Zoo), which begin week-day operation on April 15. The Aquarium, which is closed on Mondays and Tuesdays during the winter months, resumed 7-day-a-week operation on Monday, March 30. Closing time remains at 5 p.m. until May 30, however.

Mr. Crandall's Book. "The Management of Wild Mammals in Captivity," in the writing of which General Curator Emeritus Lee S. Crandall has been engaged for more than ten years, will be published in June by the University of Chicago Press. The price will be \$13.50.

35 mm. Color Slides. During an expedition to East Africa, out of which came the Zoological Society's motion picture "Wild Gold," James R. Simon took hundreds of 35 mm. color transparencies of African wildlife. Now in our photographic collection, the most striking of these slides are being made up in sets of four for sale at \$1 a set. Five sets are currently available, plus an additional set of four scenes in the Zoological Park.

Fountain Circle Enlargement. When the Fountain Circle at the north end of the Zoological Park was laid out in 1908, the comparatively few automobiles that used it for parking were considerably smaller than today's giants. As cars have increased in length, the maneuvering space in the circle has become more and more restricted. We have now embarked on an enlargement of the parking area in the circle and it will be closed to vehicles for about two months this spring. By early summer it will be reopened in a much more convenient form.

"Metabolites of the Sea." Dr. Ross F. Nigrelli was the 1964 Mendel Lecturer at St. Peter's College in Jersey City in mid-March, speaking on "Metabolites of the Sea and Their Evolutionary Significance."

"Hungry Eagles." Early this spring a local pet shop telephoned the Zoological Park to say that it had acquired two hungry "eagles" that were eating up all the profits — and would we take them off the shop's hands? Always interested in eagles, we investigated and found that they were Black-collared Hawks, *Busarellus n. nigricollis*, which range from southern Mexico to northern South America. We gladly added the birds to our collection, for they are the first of the species we have had since 1915. They will go on exhibition in the Birds of Prey Aviary when steady warm weather comes.

Cape Barren Geese. From the aviaries of Jean Delacour at Clères, in France, we have received a pair of Cape Barren Geese. A male of this species was received here in 1909 and lived until 1938. We hope that the new pair will be breeders, for we have not reared young of this increasingly endangered species since 1913.

Platypusary Is Gone. Untenanted since the death of our last Duck-billed Platypus, Pamela, in 1959, the old Platypusary in the center of the Zoological Park has been demolished and the area has been landscaped.

Babies. A list of mammals and birds born or hatched in the Zoological Park in 1962 and 1963 has been compiled, and shows: mammals, 56 species; birds, 51 species. They numbered several hundred individuals.

Hummingbird Record. What is apparently the best recorded longevity record for any hummingbird was set by an Emerald-throated Hummingbird, *Sericotes h. holosericeus*, which died on February 28, 1964, as the result of an accident. The bird came to us on July 21, 1953, and was thus in the collection for 10 years, 7 months and 7 days.

Reptile Study. A three-year grant in the sum of \$43,540 has been made by the National Institutes of Health to Dr. Herndon G. Dowling, Curator of Reptiles, and Dr. Victor Hutchison of the University of Rhode Island for studies on the metabolism of reptiles. The work will be done in the Zoological Park and will be concerned with the incubation behavior of the Indian Python.

Correction

In the November-December, 1963, issue of *Animal Kingdom*, Dr. Margaret Altmann, author of "Seniors of the Wilderness," was listed as on the staff of the University of Wyoming. Dr. Altmann is Professor of Psychology at the University of Colorado.

PUBLICATIONS OF INTEREST

THE WORLD OF THE BEAVER. Text and photographs by Leonard Lee Rue III. 155 pp., many photographs. J. B. Lippincott Co., Philadelphia, 1964. \$4.95.

THE WORLD OF THE BOBCAT. Text and photographs by Joe Van Wormer. 125 pp., many photographs. J. B. Lippincott Co., Philadelphia, 1964. \$4.95.

The "Living World" series of which these two books are a part ("The World of the White-tailed Deer" has appeared previously) is a valuable contribution to the popular natural history library. Under the editorship of John K. Terres, these two writer-photographers have distilled a great deal of field experience and close observation.

SNAKE LORE. By John Crompton. 152 pp., 20 figs. Doubleday & Co., Inc., Garden City, N. Y., 1964. \$3.95.

Mr. Crompton can spin an interesting tale and has had a couple of personal experiences with snakes in Africa. Unfortunately, however, he really does not know enough about them to write a book. — H.G.D.

NAMING THE BIRDS AT A GLANCE. By Lou Blachly and Randolph Jenks; 424 diagnostic drawings in black-and-white by Sheridan Oman. 334 pp. Alfred A. Knopf, New York, 1963. \$3.95.

Instead of color plates, this book depends upon black-and-white drawings with significant markings and colors identified and birds with characteristics in common grouped for quick identification. If even one character is clearly noted — a black cap, for example — reference to the color pattern guide on the end papers leads one to the small group that must contain the unknown. A scale of sizes and list of prominent features make identification certain. The book covers the land birds from South Carolina to the Arctic and west to the Rockies. It works.

SCREAMER. Last of the Eastern Panthers. By Robert M. McClung; illustrations by Lloyd Sandford. 64 pp., William Morrow & Co., New York, 1964. \$2.75.

With fidelity to natural history, and yet with a strong dramatic sense, the Bronx Zoo's former Curator of Mammals tells the story of the panthers that once inhabited the mountains of Pennsylvania. Children will welcome this one, as they have others of Mr. McClung's books. The lively illustrations are by the Zoo's staff artist.

THE BEAR WENT OVER THE MOUNTAIN. Tall Tales of American Animals, collected and edited by R. B. Downs. 358 pp. The Macmillan Company, New York, 1964. \$5.95.

Natural history folklore, the tall tale, what the collector of this anthology calls "apocryphal biology," is not peculiar to America, but we nourish and cherish it more than anyone else. Here, lovingly collected under one cover, are sixty-some-odd of the best tales, regionally classified and ranging from Josh Billings to Thurber. It's a kingdoodle of a collection.

THE SENSES OF ANIMALS. By L. Harrison Matthews and Maxwell Knight. 240 pp., 21 photographs. Philosophical Library, New York, 1963. \$7.50.

Although it is said to be intended for university students and teachers, "The Senses of Animals" is by no means technical. Mr. Knight's half, "Animals in the Field," draws generally on his own observations and makes suggestions for experiments. Dr. Matthews, in "How Do the Senses Work?" explains the mechanics of the senses and answers many questions the general reader would ask. The book may well stimulate student biologists; it is certain to engross the non-professional.

THE LAND AND WILDLIFE OF EURASIA. By François Bourlière and the Editors of *Life*. 198 pp., 72 pp. in color. *Life* Nature Library; Time, Inc., New York, 1964. \$3.95.

Although he deals competently and at length with the geology, climate and civilizations of Eurasia, Dr. Bourlière stresses the wildlife of that vast area and his text will be of particular interest to the Society's Members on that account. Dr. Osborn contributed an Introduction to the book, which is the first of a series of six on the major land areas of the earth. Like other books in the "Life Nature Series," (or the allied "Life Science Series") this one is superbly illustrated. Recent additions to the series include "Ecology," by Peter Farb, "Matter" by Ralph E. Lapp and "Machines" by Robert O'Brien. All are the same price, \$3.95.

ALL ABOUT TROPICAL FISH. By Derek McInerny and Geoffrey Gerard. 480 pp., more than 100 illustrations in color. 200 in monochrome, 26 line diagrams. The Macmillan Company, New York, 1963. \$15.00.

A comprehensive book covering about all the tropical fishes commonly kept by amateurs. There is a great deal of detail about living and breeding conditions, including sizes of tanks, water chemistry, temperature and food requirements of the individual fishes, where known. This is useful for those who must go by the book in their operation of their aquarium.

The photographs, either black and white or in color, are no works of art but are good enough to be used for identification.

Much auxiliary information regarding the building of tanks and other pertinent items are included, although we would be reluctant to put a tank together with glazing putty, as suggested.

On the whole a useful and informative book for the fancier and dealer. — C.W.C.

THE COMPACT BOOK OF OUTDOOR PHOTOGRAPHY.
Edited by Ray Ovington. 96 pp., 68 photographs. J. Lowell
Pratt & Co., New York, 1964. 75¢.

A pocket-sized guide to outdoor photography, with
chapters by experts in travel, sports fishing, hunting and

nature photography, and underwater photography. Rec-
ommends cameras, methods and procedures, discusses re-
cent types of camera equipment, and includes a glossary
of photographic terms and suggestions for further read-
ing. — S.D.

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THIS SPRING . . . Members are invited to 5 Special Curator-conducted Members' Tours on Saturday mornings in the Bronx Zoo and the Aquarium.

APRIL 25

According to Director of the Aquarium Christopher Coates, conditions should be ideal for taking underwater movies of the White Whales in the Aquarium's big Oceanic Pool, and a team of underwater cameramen will show Members how it's done. Before the tour ends, Members will also see the most varied collection of pinnipeds—seals, walruses, and sea lions—ever assembled.

MAY 2

Curator Dowling says that snakes use 4 means of locomotion. There's the hitch and hike, for tree climbers like Cooke's Tree Boa; the side wind for sand dwellers; the serpentine or lateral loop for the thin-bodied; and the rectilinear for the thick and heavy. You'll see all 4 kinds—without locomoting yourself.

MAY 9

Many and wonderful are the adaptations of mammals for seeing—and for not being seen. There just won't be time to see *all* the adaptations of *all* of our 204 mammalian species and subspecies, but Curator Joseph Davis will show Members some of the more remarkable examples.

MAY 16

The Zoo's new Bird Walk—a rustic bridge wandering through the domain of Egrets, Cormorants, Wood Ducks and scores of others—will be a new experience for many Members. Curators Conway and Bell will guide the walk and will also conduct Members on a comprehensive tour of the Zoo's many outdoor bird exhibits.

MAY 23

The Zoo's general breeding program is becoming of more and more importance in the conservation of wild animals. Director William Conway will show Members what is being done in the Zoo to create breeding flocks and herds and what our plans are for the future.

BASIC
TOUR
INFORMATION

Tours start promptly at 10:30 A.M., at the Sea Lion Pool in the Zoo or at the Aquarium's main entrance, and end about noon.

On Zoo tours, wired-for-sound tractor trains will carry you around the Zoo.

Tours are restricted to Members, who may each bring only one guest on any one tour.

No advance notice of attendance is necessary.

If the weather is too bad, tours are replaced by movie programs.



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ANIMAL KINGDOM



THE MAGAZINE OF THE NEW YORK ZOOLOGICAL SOCIETY

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ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

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Aid for the Animals of the Galapagos

ISLANDS — little sisters of the great continents — generally have special characteristics of their own. No islands are more unusual — from a zoological point of view — than the Galapagos, lying in the cold waters of the Humboldt current some 600 miles west of Ecuador.

Charles Darwin, in all his five years of voyaging around the world on the "*Beagle*," writes of no other place and its animal life with the same wonder and interest.

The Galapagos happen to be woven into the history of our Society. In the mid 1920s two expeditions were sent there under the leadership of William Beebe, Director of the Tropical Research Department. These resulted in more than a score of technical papers concerning the fauna of the islands, recorded in the Society's scientific publication, *Zoologica*. In addition, Dr. Beebe wrote a vivid account of the natural history of the islands in a book entitled "Galapagos, World's End."

The Society was again drawn to the Galapagos in 1928 because of the threatened extinction of much of its fauna, especially the Giant Tortoises. A "rescue program" was initiated by Dr. Charles H. Townsend, then Director of the Aquarium. As a result, some 180 tortoises of various ages and sizes were taken and transplanted to places where they could be carefully protected — in Florida, Bermuda, San Diego, Hawaii and Sydney, Australia. Quite a few of these animals have propagated and even after the intervening thirty-five years some forty or more are still alive. A principal value of this program was that it drew wide public attention to the need for preserving the islands' animal life.

Recently the Society has again been "going back" to the Galapagos. It has given financial assistance to the newly created Darwin Foundation that has now established a long-needed Research Station on Santa Cruz Island. Within the last year and a half Dr. Herndon Dowling, Curator of Reptiles, has made two field trips to gain further knowledge concerning the status of Giant Tortoises, iguanas and other species.

Finally, the Society has just made another move that we believe will prove of lasting importance in the preservation of the islands' fauna. It will provide to the Charles Darwin Foundation the funds needed for the employment, over the next three years, of a competent field conservator, who will work under the direction of the scientific staff of the Darwin Station on Santa Cruz. This plan holds the promise of proving a turning-point in the survival of the unique animals that inhabit this faraway oceanic region.

Fairfield Osborn

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JUN 17 1964

THE MUTTON BIRDS



OF BASS STRAIT

By JOHN WARHAM

BACK IN 1798, in the days of "iron men and wooden ships," Captain Matthew Flinders, R.N., and Surgeon Bass made the first circumnavigation of Van Diemen's Land, now called Tasmania. Despite the hazards of a journey under sail through unknown seas and in an ill-found craft, they kept meticulous records of all they saw. One of the most remarkable episodes was their encounter with hordes of "sooty petrels" in the area now known as eastern Bass Strait. In his journal, Flinders describes how "There was a stream of from fifty to eighty yards in depth, and of three hundred yards or more, in breadth; the birds were not scattered but flying as compactly as a free movement of their wings would allow; and during a full *hour and a half*, this stream of petrels continued to pass without interruption, at a rate little inferior to the swiftness of a pigeon." Allowing nine cubic yards of space to each bird, Flinders calculated that no less than 151,500,000 birds passed by. Even though his calculations were slightly out — the correct computation is said to be around 132,000,000 — that's a lot of birds. . . .

The "sooty petrels" seen by Flinders and by Captain Cook before him are still extremely numerous and some people believe that they may be Australia's most abundant birds. Nowadays they are known as Tasmanian Mutton-birds or Short-tailed Shearwaters, *Puffinus tenuirostris*.

Shearwaters are burrowing petrels, named from their habit of flying at high speed hugging the waves so that, in the words of one ocean traveller, "you could hardly slip a dinner plate between them and the water." The Tasmanian species has a plump body clothed in glossy brown feathers and it has a rather dark and hooked bill and dark webbed feet. It is about 15 inches

long and has a wing span of around three feet. Since the earliest days of Tasmania's settlement by white men, and doubtless by the aborigines before them, the mutton-bird has been used as food much as sea-bird chicks in the northern hemisphere at places like the Faroes are still harvested at the present time for local consumption. Despite its name the bird really tastes nothing like mutton but rather like chicken and the origin of the term mutton-bird is disputed.

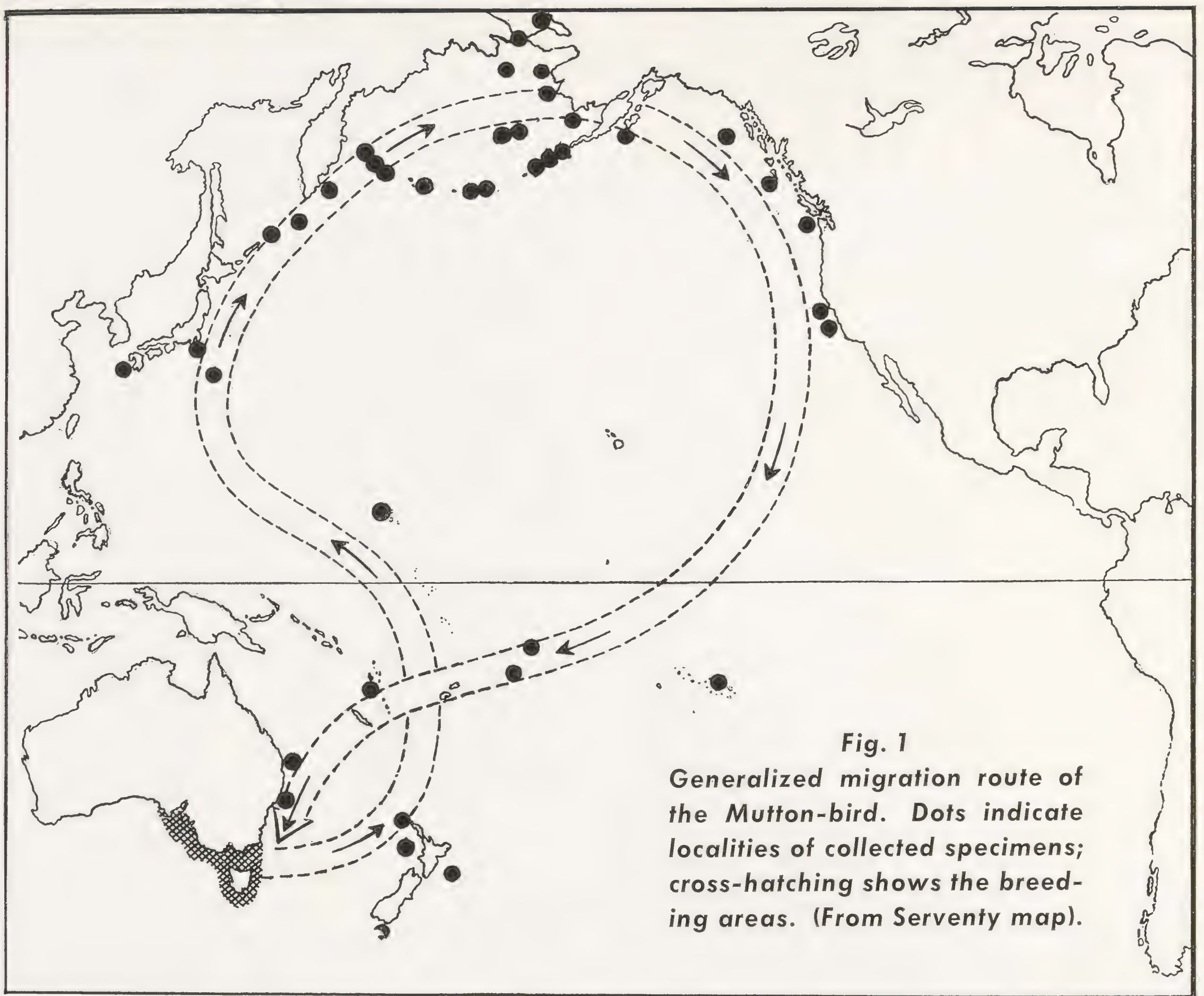
As part of long-term studies of petrels my wife and I spent five months on one of three islands in Bass Strait known as the Babel Group where mutton-birds abound. The islands were named by Flinders during his 1798 expedition. He records how Bass went ashore and brought back a load of seals and gannets for food and adds "Besides these the islet is inhabited by geese, shags, penguins, gulls and sooty petrels, each occupying its separate district and using its own language. It was the confusion of noises among these various animals which induced me to give the name Babel Isles to this small cluster."

That name is still apt today. Unless a gale was blowing, our island, uninhabited by human kind, was quiet and peaceful by day but at dusk hordes of mutton-birds converged towards it. They were silent at first but so great were their numbers that the sighing of their pinions slicing the air overhead filled the dusk with an eerie hissing like the wind whining through invisible pine trees. Once the birds were on the ground, raking out their burrows, courting and crowing with the weird incoherent splutterings that serve as song among shearwaters, while others overhead crooned and wailed, it seemed as though pandemonium had broken out. Added to these cries were the violent and unmusical brayings of the resident Little Penguins which also became active after dark, and you can imagine just what a babel of sound ebbed and flowed around the tiny hut where we lived.

Ours was the second largest of the Babel Group

Uninhabited except by the author and his wife, the island in Bass Strait was quiet and peaceful by day. At dusk the birds converged on the island, sweeping overhead with hissing pinions like wind in the pines.

All Photographs by the Author



but it only covered about 100 acres. All the ground deep enough for burrowing was burrowed and we estimated that the colony here consisted of about 250,000 pairs of mutton-birds. In addition an unknown but certainly substantial population of non-breeding birds was ashore for much of the breeding season. If an island as small as this can support at least a quarter-million pairs, the populations that breed on the many larger islands colonized by these mutton-birds must be colossal.

Modern research on shearwaters may be considered to begin with the pre-World War II studies made by R. M. Lockley on the West Wales island of Skokholm. To date about 96,000 Manx Shearwaters, *Puffinus puffinus*, have been leg-banded in that area but considering the size of the effort the results have in some ways been rather meager, partly because much of the early marking was done with aluminum bands which soon fall off owing to corrosion and abrasion. In contrast, in the studies on the Tasmanian Mut-

ton-bird, which have only been under way since 1947, most of the 32,000 birds so far marked have been fitted with monel bands whose life is greater than that of the bird, and this itself is considerable.

This research has centered on Fisher Island in Bass Strait and the driving force behind the project is an Australian government biologist, Dr. D. L. Serventy. His work is supported jointly by the Tasmanian Fauna Board and the Commonwealth Scientific and Industrial Research Organisation (C.S.I.R.O.). The work at the Fisher Island station has many ramifications, but one of the most important is the building up, over the years, of the biographies of the mutton-birds breeding there. Each has its life story recorded on a card index. If you pick up a shearwater on the rookery at night and read the band number, then, by referring to the appropriate card, you can probably learn the date and burrow of its birth, the band numbers of its parents, the date at which it first returned to the island as a non-

breeder, when and where it first bred and with what partner, and so on.

The data show that Tasmanian Mutton-birds often live a long time once they have achieved maturity and although only one egg is produced by each pair annually, they may breed for many years. Several are still breeding on the island which were first marked when nesting back in 1947. Immaturity also lasts a long time compared with most other birds. Females do not start to breed until they are five years old and the males, in general, not until they are seven years old. Once breeding does start the banding results show that the birds have a strong tendency to return to the same burrow year after year and to remain faithful to their mates. Furthermore, many immatures also return to the very island where they were hatched. But such birds do not appear on land until they are at least three years old and they then arrive some weeks after the breeders make their landfall. These immatures spend several years as "sweathearting birds" before they breed successfully. During these seasons they acquire mates and eventually burrows and go through the motions of breeding without producing viable eggs. Presently they may produce an egg but often on the first occasion they will fail to hatch it, even laying it on the surface, but maybe the following year they will be more

successful and may rear a chick. They have then reached adulthood.

After breeding is over Tasmanian Mutton-birds disappear from Australian seas and they migrate to the north Pacific Ocean, even penetrating into the Bering Sea. They provide a contrast to the usual situation among migratory birds in breeding in the warmer of the two regions between which they travel. The sea in Bass Strait is at 14 to 17°C whereas Captain Cook saw the birds in the north Pacific among ice-floes, and off Kamchatka, where they are common in July, the sea temperature is only 3 to 7°C.

Dr. Serventy worked out the migratory path (Figure 1) by plotting on the map where Tasmanian Mutton-birds had been collected or identified at sea. The figure-of-eight path so revealed is being confirmed by the recoveries in northern waters of chicks and adults banded at the nesting islands. Thus a chick marked during our stay in the Babel Group on March 30, 1958, was recovered, tangled in a Japanese salmon net, in the Aleutians on July 12 of the same year. During August and September the clockwise move-

Banding a Mutton-bird chick on Babel Island. This work by Dr. Serventy (right) tells much about the birds — for instance, immatures are likely to return to the island where hatched.

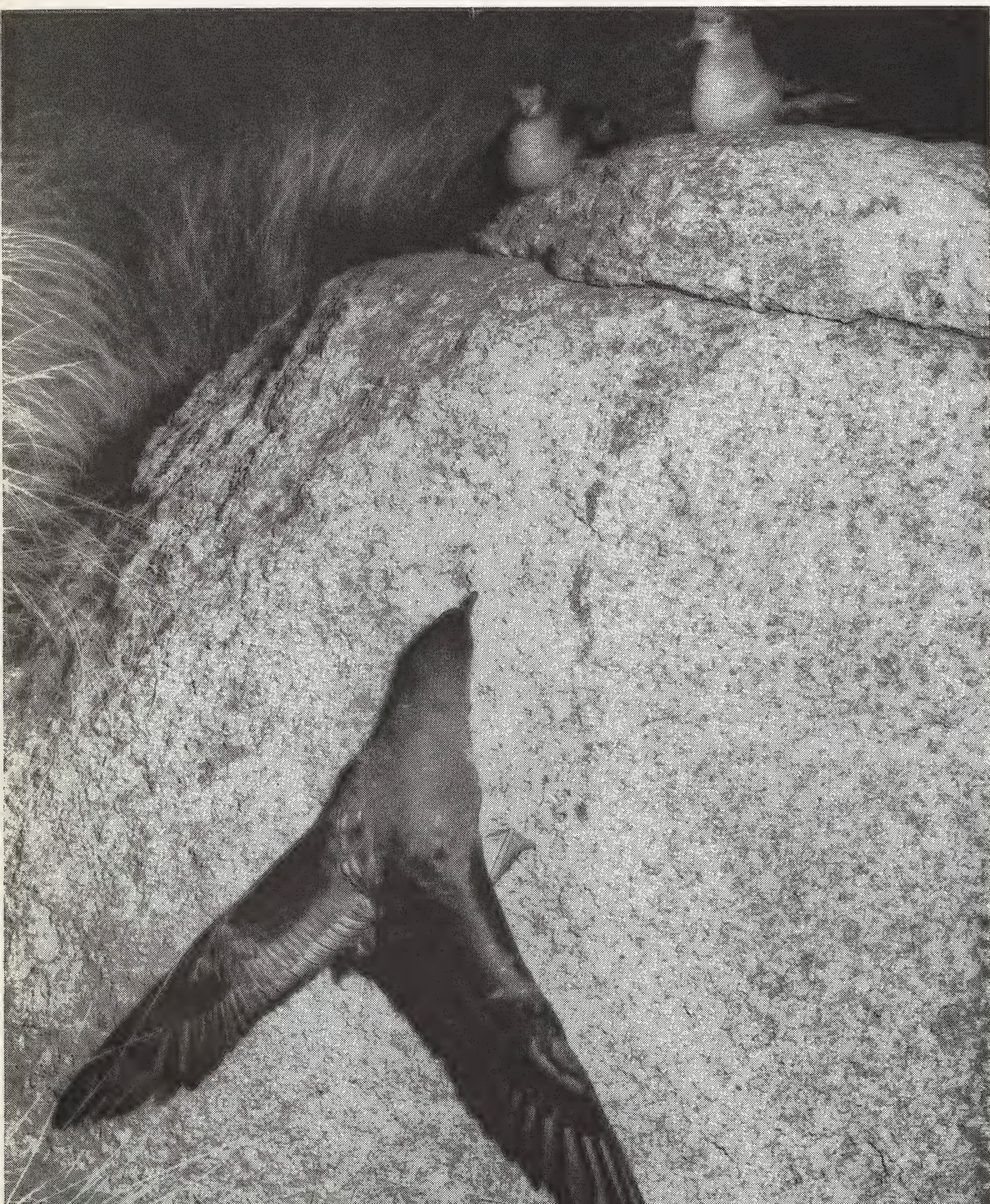


ment brings the birds down the Alaska coast and then southwards where big flocks feed off British Columbia, Oregon and California. Mutton-birds are most plentiful in Californian seas in December but as the adults are breeding at that time, such flocks are presumably immature birds.

One of the most remarkable things about this migration is not merely its extent — covering about 21,000 miles between breeding stations — but its timing. Whatever the weather on the way, the adults somehow manage to make their landfall on virtually the same date each year. And the dates today are the same as those 100 years ago when records first began. The shearwaters return on the nights of September 26 and 27 and all seem to have returned by the end of the month.

On arrival their gonads are found to be enlarged so that the seasonal sexual cycle must have been triggered off by some event in the northern hemisphere. As the dates of egg-laying are just as constant as the arrival dates, it seems that

some astronomical event regulates the cycle but it is difficult to visualize how a factor such as decreasing day length can be responsible with birds spread out widely across northern seas and subject to widely differing rates of change in day length as they move southwards. This sort of mechanism could perhaps be responsible if the adults (as opposed to the non-breeders) are confined to restricted areas during their stay in northern seas, but we do not know if they are restricted in this manner. Experiments are being conducted in Perth, Western Australia, by Dr. Serventy and Prof. A. J. Marshall to elucidate the factors involved. Their joint work is currently being supported through a grant made by the U.S. Office of Naval Research. They are subjecting captive mutton-birds to varying light treatments to test whether photo-stimulation is a factor. It is also proposed to attempt radio-transmitter experiments in conjunction with mobile radar sets to trace out the migratory paths of the birds in more detail.



Rock-scaling is accomplished by the aid of the hooked bill, depressed tail, the wing tips and a firm grip with toes and webs.

When my wife and I arrived in the Babel Group it was November 14 and the mutton-birds had been back about three weeks. Yet for the first few nights not a one flew overhead; the burrows, too, were empty and, apart from the penguins' cries, the nights were silent. But the mutton-birds had obviously been ashore not long before as their burrows were freshly raked out and the ground splashed with faeces. We were witnessing a type of behavior apparently unique to petrels, the so-called pre-laying exodus. About three weeks before the eggs appear all the birds desert the islands and stay at sea until the females are ready to lay. Then they all return as abruptly as they left. Laying begins at once and when our birds re-appeared on the night of November 17 we could plainly feel the eggs inside the pregnant females. The eggs are large for the size of the bird and may account for the exodus, the females needing to feed while they produce an egg that amounts to 16% of their own weight.

At the mutton-bird colonies every burrow seems to have its occupants and some females, apparently lacking a burrow of their own, lay on the surface. Such eggs are eaten at daybreak by the gulls and ravens and amount to quite a lot of eggs. Even on our small island we reckoned that around 1,150 eggs were laid and lost in this way.

When the adults returned after their exodus they carried extensive deposits of subcutaneous fat. The reason was soon apparent, for the females presently returned to sea, leaving the males to take the first stint at incubating the eggs. This lasted for 11 to 14 days during which time the males survived on their body fat, as they never left the eggs. When their mates re-appeared the males were much thinner and it was now the females' turn to fast until, in due course, they too were relieved. This routine lasted for 55 to 57 days and then the eggs began to hatch.

The resulting downy chicks looked like soft gray powder puffs. For two days and nights each was brooded by one of the parents but thereafter each remained unguarded in its burrow by day and was not brooded again. But at night one or other of the parent birds returned to dish out meals of regurgitated crustacea.

We watched events at nests which we fitted with false roofs, doing this in the parent's absence by day. Then, over several days we put up hard-



Courtship between pairs of Mutton-birds takes place after dark on the surface of the rookery.



In its underground burrow, an adult with eyes closed gently preens a chick of the downy age.



Feeding: the chick places its beak across that of the parent, on top of the latter's tongue.



board blinds on top of the nesting chambers, leaving the approach tunnels intact. At night, by raising the roofs and using a dull red light, we watched what happened underground with the birds at our feet.

As the first shearwaters came sweeping over the islands I would close the door of the blind behind me. Below in the nest the chick stirred; a dark, pulsating ball of fluff. About three-quarters of an hour sufficed to bring in the bulk of the breeding birds and my study birds usually came in with the rest. I was suddenly aware through a peephole of a shearwater outside with its neck stretched out towards the tunnel as if sniffing the entrance. Shortly after this the parent's black bill extended into the nest and the bird cautiously worked its way inside.

By now the chick was alert and chittering softly. The adult usually nibbled with its bill at the young one's head, preening it gently. The chick's response was to jab its own beak vaguely towards the parent's head. The old bird closed its eyes apparently to protect them and then opened its bill and so permitted the chick to place its own beak inside and across that of the adult.

The birds and venomous Tiger Snakes often share a burrow. The snakes eat eggs and very young chicks, but this one is too large to be suitable prey.

A licensed "Mutton-bird" carries a load of fat squabs from a rookery on Babel Island to the processing sheds where they will be prepared for sale.

The latter regurgitated so that the food was diverted from its own bill into that of the nestling. Most evenings the chicks received a series of such meals, perhaps twenty in all, after which both chicks and parents slept.

But after the chicks' first week or so of life the visits of the adults became more erratic and subsequently the young birds received a meal only about once weekly. However, these were very substantial meals, amounting at times to as much as 20% of the chick's own weight. By sleeping for much of the time the chicks conserved energy and the thick down has considerable insulating power. Drs. Serventy and Farner have shown that the temperature-regulating



mechanism is well developed in the chick at four days old and that the micro-climate in the burrow is free from the violent fluctuations characteristic of the outside air.

Rearing the chicks took about 94 days and weighings made at Fisher Island show that at about a month old the chick's weight exceeds

In periods of calm, the Mutton-birds must gain height for take-off in flight. Here several of them have climbed a rock just before dawn.

that of either parent but thereafter the weight slowly declines. During their last fortnight in the nest the chicks remain unfed, deserted by the parents. The onset of the migratory urge seems to call the old birds back to sea but it is not known whether they fly north in advance of the birds of the year. The latter make their way to the water by night and soon leave Tasmanian waters, for a banded chick got to Japanese seas within a month of fledging.

The regularity of the breeding timetable and the high mortality that occurs between fledging and the attainment of adulthood (which means that chicks can be harvested with little effect on the adult population) has enabled a small industry to develop around the mutton-bird. It is all strictly controlled. Only the fat squabs are taken and these only by licensed "birders." The chicks are killed, plucked and salted down in barrels for sale in city shops or for personal consumption by the licensees. Little is wasted. The down is perfect for lining sleeping bags and the stomach oil, squeezed from the squabs during preparation, is used medicinally. In recent years





“Shearwater” is an apt name, for the birds fly rapidly and just above the surface of the sea.

the number of birds taken has been falling owing to the changing habits of the part-aboriginal Cape Barren Islanders, traditionally the mainstay of the industry, and transport difficulties. In 1963, 406,000 birds were taken by 91 licensed trappers and the crop was valued at \$84,000.

Natural enemies of the mutton-bird are relatively few. Gulls, ravens, eagles and hawks take any found on land by day and lizards and snakes take eggs and small chicks. I saw Tiger Snakes with two-day-old chicks in their mouths but at about two weeks most nestlings seem too big for the snakes to take and the two animals often share burrows amicably. The snakes are extremely venomous, with venom said to be about 40 times as toxic as potassium cyanide, but we found them very timid, though very plentiful. Their presence adds a measure of excitement to the business of withdrawing chicks from the burrows for banding and the “mutton-birders” generally carry a syringe and antivenine for use in emergency.

Like other shearwaters, Tasmanian Mutton-birds are ungainly on land. Their legs are set rather far back on their bodies and these seem to be heavy in relation to the wing area. Thus on calm nights the birds experience difficulty in becoming airborne and climb suitable rocks to gain height for the take-off. At busy colonies, in the last hour before dawn, favored rocks become blackened by birds jostling each other in their eagerness to be away before daylight. Once in the air they fly fast, swooping and gliding across the stormy seas and taking advantage of the winds deflected upwards from the sides of the waves. During the breeding season the feathers contouring the body are gradually replaced but when they set off on migration the birds are still full-winged. Once their winter quarters are reached, however, the flight quills are evidently shed rapidly for there are reports of the seas being strewn with their feathers. This pattern of molting whereby there is a delay between wing and body molts seems a nice adaptation to migratory needs for, clearly, without full wings the birds would be unable to perform their long and arduous migration to northern seas.

The Art of Keeping Marine Iguanas

Keeping the Marine Iguana (Amblyrhynchus cristatus) of the Galapagos in captivity is an art that few have mastered. As Curator Dowling reported in the November-December, 1962, issue of Animal Kingdom, Karl Angermeyer has induced Marine Iguanas to eat table scraps at his home on Santa Cruz in the Galapagos. They were, however, free-roaming and not in captivity. We were less successful with specimens brought to the Zoological Park by Dr. Dowling in 1962; they survived only from June 16 to December 3 of that year.

Dr. Irenaus Eibl-Eibesfeldt of the Max-Planck Institute in Germany, who has made many observations on the life and behavior of the Marine Iguana and has observed Karl Angermeyer's procedures, has done exceptionally well with these sea-going lizards in his laboratory in Germany. He writes of them as follows. — EDITOR.

By IRENAUS EIBL-EIBESFELDT

Max-Planck Institut

REPEATED attempts to keep Marine Iguanas in captivity have been made. The animals refused to take food, however, and most died within a short time. The Zoological Society of London once kept four individuals and S. S. Flower, in his 1937 report on longevities, noted that the last of these died after one year and five months. Details were not given, but to my knowledge this is the longest record of keeping the species alive in captivity until quite recently.

It has been assumed that the difficulties are due to the animals being specialized for a diet of seaweed for which there is no appropriate substitute. On the Galapagos, however, one may occasionally observe the animals feeding on the afterbirth of Sealions, and Mr. Angermeyer, whose home is on the shore of Santa Cruz (Indefatigable) Island, feeds rice, fish and bread to the iguanas that visit his verandah. A Marine Iguana that was thus accustomed to "civilized" food was sent to the Frankfurt Zoo in 1960 and is still (March, 1964) alive. Other iguanas sent there died.

Since I wanted to continue in our laboratory certain behavioral studies started in the Galapagos, I made a trial of my own. In June, 1962, I received eight young Marine Iguanas which had been caught in May on Indefatigable Island. They were only a couple of weeks old. During the first weeks I spent a large part of my time caring for them. They were put in a terrarium outfitted with stones and sand, lamps and radiators. On the day they arrived, I tried to feed them with chopped mice. All touched the pieces

These Marine Iguanas have crawled up from the sea to take food from the hands of Karl Angermeyer at his home on Santa Cruz. Surprisingly, they readily accepted table scraps.

Photos by the Author





At low tide the iguanas swarm out into the intertidal region to feed on marine algae, which they gather by biting with the side of the jaw.

Dr. Eibl-Eibesfeldt found that iguanas in his terrarium liked to be fed by hand and would take a variety of foods by nibbling from the forceps.

thrown in front of them, but only one swallowed a small piece.

Two days later they were moved to a larger terrarium. When I tried, again and again, to offer new food I noticed that they were attracted by moving objects. Earthworms were grasped and shaken, but all but one lizard spat them out again. The following day I succeeded in feeding them mealworms and wax-moth grubs. A week

after arrival all were eating regularly. Their diet up to now consists of chopped newborn or very young mice and rats, herring, shrimp, cooked rice, mashed carrots both raw and cooked, green lettuce cut into small pieces, tomatoes, bananas and a commercial vitamin preparation ("Prophylaktin Ultra" Altrogge), all thoroughly mixed together. Sometimes they get crickets, but not too many, since there is evidence that such insects caused the death of one lizard by constipation.

They catch their prey skillfully and like to be fed by hand. When they grasp the forceps, they never bite hard against the metal but start a rapid, soft nibbling.

A dish with fresh water and another with salt water are always in the terrarium; they drink from both, but prefer the fresh water.

They swallow pebbles. It seems to be a normal habit and my guess is that the stones serve as a ballast. Crocodiles are known to swallow stones, probably for this purpose, and seals also. Watching Marine Iguanas on the floor of the sea, it is noticeable that they have no particular buoyancy.

In October, 1962, the iguanas became quarrelsome and I had to split the group. Three were given to Frankfurt Zoo and four were kept (one of my original eight had died, as mentioned above). Among these four there developed a hierarchy that was stable for some weeks. For a while the largest iguana chased the smallest, and only this one, and bit it. Later this behavior was reversed and the smallest chased the largest, but only if the latter entered the smaller one's territory. In December head-pushing was first observed; this is part of the territorial behavior.



My four animals have done very well. They are still alive (March, 1964) and the largest, which measured 30 cm. (11.8 in.) on arrival has increased to 72 cm. (28.3 in.) in length and is very stout.

The iguanas are quite tame and like to be scratched. When they moult, their skin peels off

in pieces. My subjective impression is that when I assist moulting by tearing away parts of the old skin, they find this comforting. They are active and amusing creatures and not really difficult to keep in captivity if one starts with young animals and invests enough time in the beginning to accustom them to the new diet.

Safe Hiding Places Moved While You Wait

By CHRISTOPHER W. COATES

Director, New York Aquarium

FISHES ARE MANY THINGS to many people, for the barrier between the air-breathing creatures and those that breathe water is normally a difficult one to breach, and to translate the behavior of those so different from us is not always easily done.

Many people think of fishes as merely something to eat — in some markets, indeed, the fish-monger makes no distinction at all as to kind, simply labelling everything “fish.” Some people think of fishes as pleasant little bits of colored mobility to be kept in a tank. A very great many think of fish, all fish, as something to catch.

Scuba diving has opened up for many people a completely new vista in the lives of free-ranging fishes and their inter-relationships. Too, any observant fish fancier must be aware of differences in behavior between his fishes and other animals — his dog, for instance. Even so, to most of us the “way of life” of a fish is so foreign to our thinking that we miss most of what may be going on in a fish tank and dismiss the rest as of no meaning to us.

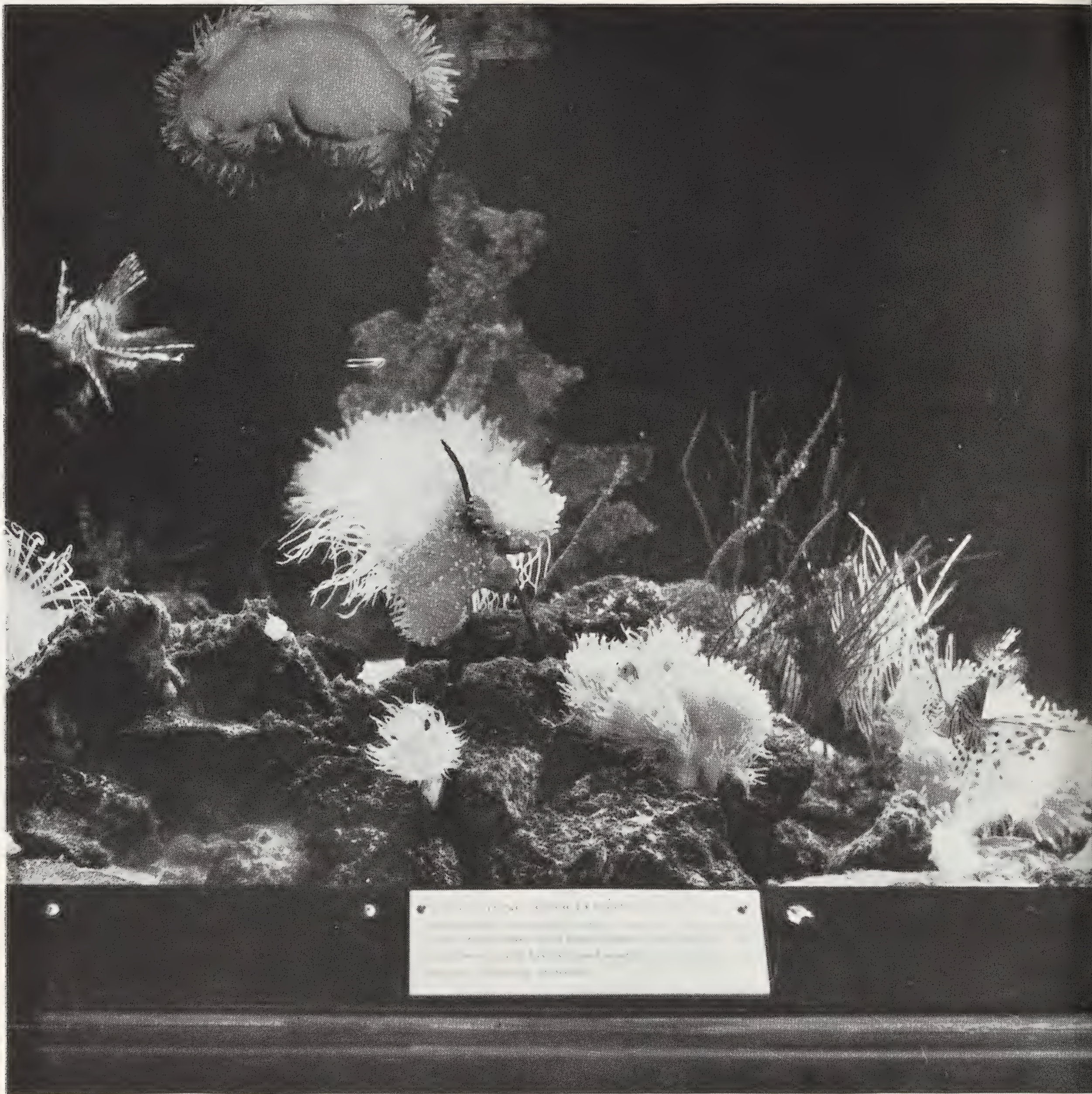
Once in a while the curtain parts and we see bits of behavior about which there can be no doubt whatever, it would seem.

An instance of this kind occurred recently in one of the tanks in the New York Aquarium. This is a tank of which we are particularly proud, for it probably has no duplicate in any other aquarium. It presents an almost complete biota established by a greatly varied group of invertebrates, animals notoriously difficult to keep for any length of time. This tank has been running without interruption for more than four years and in it are a great many *Cerianthus*, anemone-like creatures which live in tubes of their own making, as well as anemones of several species, some quite large. The tentacles of the anemones are well equipped with myriads of stinging cells which may easily cause fatal poisoning to any fish that unfortunately gets close enough to be caught by them.

There are living corals, seawhips, and tube worms with their lovely plumes which may be withdrawn in the winking of an eye — a really fantastic collection of living things, all getting along very well together.

When we established it, the tank was lovely to look at, but aside from the waving of the tentacles of the anemones it was largely static.

For this reason, and because there is another



phenomenon of the seas which is somewhat startling, we introduced into the tank a number of anemone fishes. These are smallish fishes, ranging from about three to five inches. All are highly colored in various shades of yellow, from bright canary to dark reddish-yellow, and with stripes of vividly contrasting colors. These fishes and the anemones have somehow come to an arrangement by which a fish may seek refuge within the tentacles of the anemone when it pleases, and for which it seems willing to take bits of food to the

anemone as a sort of rent. This interpretation in human terms may be wrong, but in fact the fishes do take bits of food to the anemones and do hide in the tentacles whenever they are threatened, emerging and re-entering at will without being stung.

At one time it was thought that each specific anemone fish sought only one single species of anemone, but we have found that by mixing different species of fishes with a single species of anemone, or by using different kinds of anemones

with a single species of fish, they all sooner or later get together in perfect harmony, with only one reservation; this is, that if there are too many fishes seeking refuge in too few anemones, the anemones seem to give up and soon die.

There is no likelihood of this happening in our treasured tank, however, for there is a profusion of anemones, almost a carpet of them on the floor and lower rocks of the tank.

By one of the vicissitudes that may occur in an aquarium, we found ourselves saddled with a group of Lion or Zebra Fish, spectacular creatures which prey upon smaller fishes, swallowing them so fast it is almost impossible to follow the motion. These silver-and-black creatures have enormously extended dorsal and pectoral fins which may be spread in front of a potential victim and which seem to immobilize it while the Zebra Fish drifts into attack range with almost imperceptible motions of its swimming fins.

The end of such an attack almost invariably is the loss of a fish, even fishes almost as large as the Zebra Fish itself.

These fish require water of a certain chemistry, and by a peculiar set of circumstances at the time when we had excess Zebra Fishes, the only suitable water was in the tank with the anemones and anemone fishes.

Having no alternative, we put the Zebra Fish into the anemone tank.

Naturally, the Zebra Fish made a few tentative passes at the anemone fish, an acceptable food for them, and equally naturally the anemone

This left the greater part of the tank above the bottom almost vacant, a condition the anemone fishes did not seem to like, for occasionally they would take an anemone high up in the water and put it on the glass wall of the tank, or on a protruding rib of sea fan or other convenient place so that their spread of shelters and therefore their safe range were considerably extended.

I say they would take it up. It was not quite that simple. Each of the anemones was very much larger than any anemone fish, and furthermore, is quite firmly attached to its base by its broad foot, which might be more than twelve inches long by six across. Anyone who has tried to free an anemone, even a small one, from its base will know that the animal may be torn in two before it lets go. However, these small fishes managed to move the anemones around apparently as they pleased.

The trick lies in the bit of behavior which may be seen when the curtain parts once in a while on the lives of animals and we see something about which there can be no mistaking the purpose.

When the fish decide to move an anemone, five or six of them will go to the base of the anemone pedestal, the edge of the foot, and gently but persistently nudge it for as long as half an hour. Eventually the anemone releases its hold on the rock and each fish takes a tentacle in its mouth and swimming together they carry the anemone to the chosen site. Here they hold it until the anemone, with its reaching foot, attaches to the new base. A safe refuge, a "fort," has thus been established on a new frontier.

If the anemone falls down, as sometimes occurs, the fish patiently replace it until it holds firmly.

The fish have actually perched an anemone on a slender stalk, not more than quarter of an inch across, while the anemone foot was more than five inches across and could only find its own folded self to hold on to.

There can be no mistaking the purpose of this behavior, we would think, but we find it difficult to conceive of these fish, which are not as highly developed as some other fishes, being able to work out such a scheme which involves concerted action. However, we report what we see and which anyone may see if he watches long enough — and just wonder at the works of nature!

Two of these many-tentacled sea anemones have been picked up by anemone fish and moved from the rocks — one to the glass front of the tank, another to a stem. A Zebra Fish is at the upper left.

fish darted into the nearest anemone and were saved. The Zebra Fish apparently got a few stings from the anemone while closing its fins.

In a little while it was quite apparent that the Zebra Fish gave up all hope of catching the anemone fish as long as they were near the anemones, and paid them no further attention. However, if a fish ventured too far away from the protecting carpet of anemones, it would be pursued immediately by one or more of the Zebras.

Zoo News In Pictures

Photographs by
SAM DUNTON



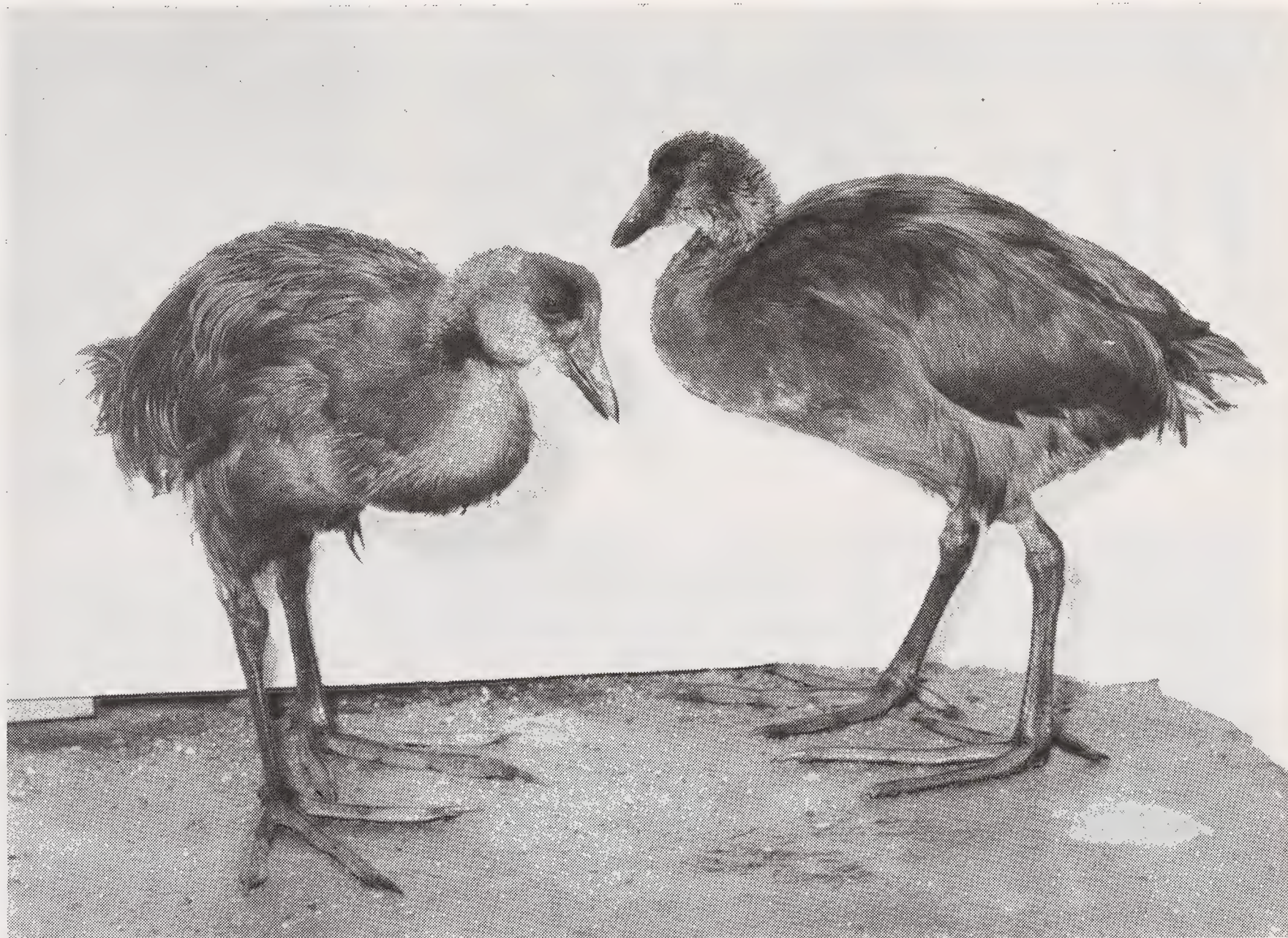
The young male Mountain Gorilla named Pilipili which we acquired last spring is spending his first summer out-of-doors at the Great Apes House and is enjoying it.



Resting a chin on another Hippo's back is a Hippopotamus characteristic. Phoebe, a pillow on countless occasions for her daughter, now takes her turn.



*The Giant Coot, **Fulica gigantea**, from the Andes is the largest of the coots and rare in zoos; our two are probably the first to be exhibited in America.*



An orphaned Aoudad is an unexpected star in the Animal Nursery this summer; it can be left at liberty and has especially attracted youngsters.



These are a mere handful of the 48 Boa Constrictors born in the Zoo on April 28, the first actually bred in the Park. Other zoos took 35 of them.



Killer with a Future—

THE FISHER

By LAURENCE PRINGLE

A HELICOPTER whirled over snow-tipped Oregon timber and landed in a meadow. Men unloaded eleven cages from the craft. Then each cage was opened and eleven dark, fox-sized animals dashed for cover.

The animals were Fishers, and Oregon is just one of five northern states that are importing them. During the past seven years Wisconsin, Montana, Idaho and Vermont have also stocked Fishers. These big weasels are being imported for one main reason: they eat Porcupines.

Controlling Porcupines has been a problem of state and federal forestry agencies for many years. Only forest fires kill or maim more trees. A Vermont forester calls the Porcupine "the most destructive forest animal pest" in his state. Other foresters agree. They have trapped, shot and poisoned Porcupines without much success. Now they are turning to the Fisher as a natural Porcupine control.

The Fisher is a little-known member of the North American weasel family. Its fur is not as popular as that of mink, otter, or sable; its smell doesn't match the skunk; it isn't as deep in our natural history folklore as the weasel and Wolverine, and it usually hunts at night in wilderness timber and therefore is seldom seen.

As a result, there is some disagreement among outdoorsmen about the species' habits. For example, the name "Fisher" is apparently based on reports that it is an aquatic, fish-eating creature. This description still pops up in some books and magazine articles. Yet several studies have shown that Fishers seldom eat fish.



Above — Oregon's Rogue River National Forest gets a stock of Fishers. Right — Dens may be high in a hollow tree, as here, or hidden in a rock crevice.

Photos: Above—American Forests Magazine; Right—Ken Gray, Maine Dept. of Inland Fisheries & Game.

The species' alternate names — pekan, black cat, Pennant marten — are not much more appropriate. Its scientific name is *Martes pennanti* and the generic name, *Martes*, is shared with its cousin, the American sable, or Marten. Perhaps the Chippewa Indians have the best name of all — *tha-cho* — which means "big marten."

Some early naturalists claimed that Fishers spend much of their time in treetops, chasing down speedy Red Squirrels and speedier Martens. Because of this alleged predation on the nimble Martens, Fishers have been called "the fastest North American mammal." All this can be traced back to Ernest Thompson Seton's *Lives of Game Animals*, which describes a Fisher chasing a Marten through the treetops. Also, Marten hair and bones are found in Fisher stomachs occasionally. However, Fishers sometimes rob trappers of their catch, and this may account for the Marten remains in their stomachs.

Although Seton called the Fisher "our most active arboreal animal," other observers would probably give this title to a squirrel, or the Marten. Fishers climb many trees but their aerial mobility has been exaggerated. After a couple of hundred miles on Fisher trails, I can only recall three instances where a Fisher climbed one tree and traveled through branches to come down another.

I began tracking Fishers in 1955, joining a group of Cornell undergraduates who liked snowshoeing in the Adirondack Mountains during Christmas vacations. To finance our trips, we tried to trap some Fishers, otters, and other furbearers. However, most of our time was spent tracking Fishers. We enjoyed the challenge of unraveling their trails, and discovered something about their ecology at the same time.

Fishers often roam a dozen miles a night, touring mountain tops, steep ledges, tangles of wind-thrown trees and spruce swamps. Sometimes the trail was too rough to follow. One Fisher swam across a branch of the Moose River, through 40

yards of swift, frigid water. We crossed a dam farther upstream and picked up the trail again. We often followed a Fisher all day without reaching the animal's den.

One of the goals of our tracking was finding where the animals denned, in hopes of seeing a Fisher. Most of the time the dens were inaccessible, deep in a rocky hole or high in a hollow tree. However, one day a track led to one of a different sort.

While hiking alone in December, 1959, I found a fresh Fisher track crossing an Adirondack woods road. Fisher tracks have a pattern similar to those of many weasels — prints side by side,



one slightly behind the other — and are about two to five inches long in snow. The size of the prints I found hinted that the animal was a male, since male Fishers are nearly double the size of females.

As I tracked the animal, sometimes there were bits of bark on the snow beneath trees, showing that the Fisher had climbed. Why he climbed, and how far, were mysteries. Perhaps he just scrambled up a few feet to survey the land ahead. Or he may have climbed 50 feet or more to catch a sleeping squirrel in its nest. Each time the Fisher's tracks led away from the same tree it had climbed.

Once the tracks led to a decayed log and the snow was littered with wood from the Fisher's digging. A spot of blood and a few tiny hairs marked the snow, probably the remains of a Deer Mouse.

The tracks also led to a deer carcass, and a bit later to a bear carcass. Both were hunting season left-overs, highly prized by the Fishers, foxes, Bobcats, birds and other meat-eaters who struggled for life in Adirondack winters. There were tracks of another, smaller Fisher at the bear car-

cass, but I decided to keep on the original trail. Fishers often go to a den after eating, and quite a bit of frozen meat had been gnawed from the bear.

A half-mile later the tracks led to a gaping hollow in a fallen yellow birch. I took a flashlight from my pack and peered cautiously into the hole. The beam caught the glint of eyes, just eight feet away. Then I could see the big Fisher.

His eyes glowed green from a pointed face that was topped by short, rounded ears. The fur of his head and shoulders was a grizzly-gray color, but his back, tail, sides and feet were a rich dark brown. He gave a soft grunting sound and moved hesitantly toward me, eager to leave the den. I blocked the hole with my pack and hastily assembled camera and flash equipment. Then (guessing at the exposure and distance), I took a once-in-a-lifetime picture: a Fisher in its den. (I guessed wrong).

After I stepped back a few yards from the log, the Fisher slipped quickly from the hole, paused to look at me and then loped off. He ran along my snowshoe trail for faster traveling and was out of sight in a few seconds.

Each of these big weasels has a home range of about ten square miles, which it shares with several other Fishers. The animals seem to know the land thoroughly, judging from the direct routes they sometimes take to dens and animal carcasses. Fishers seem to patrol their home in a rough circuit, and trappers count on them to appear in a certain area every week or so.

A few times we came upon a Fisher trail so fresh that it had to be made in the daytime. Once we spent a day trailing a Fisher that seemed to be just ahead of us. It repeatedly climbed onto logs and hummocks, pausing as if looking back. After about seven miles of this, my partner and I gave up. We never felt that such effort was wasted, because each trail revealed something more about the natural history of the animals: their home range, behavior, foods.

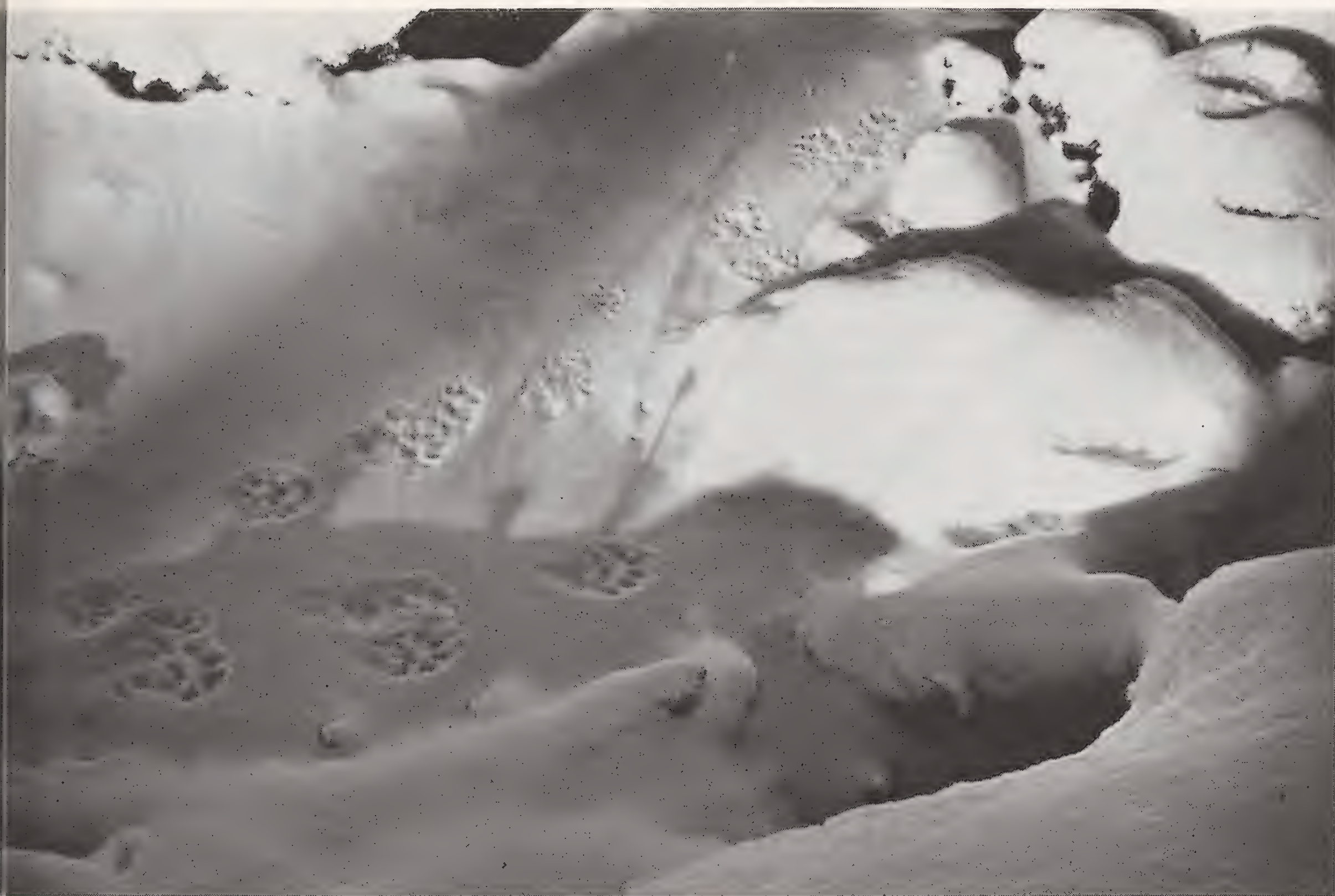
Fishers eat mice, shrews, Snowshoe Hares, squirrels, birds and anything else that is handy.

Tracking Fishers is rugged exercise, for they often travel a dozen miles each night through mountainous terrain. This is Fisher country at Old Forge in the southern Adirondack area.

Photo by the Author

ANIMAL KINGDOM





Two Fishers passed this way on the snow-covered ice of a small brook, leaving clear impressions of their five-toed feet as they ambled along.

Photo by the Author

Fishers climb many trees, but their mobility in the treetops is usually exaggerated — for example, they seldom jump from one tree to another.

Photo: Ontario Dept. of Lands & Forests

One dug up a nest of dormant white-faced hornets. Even berries and other vegetable matter are eaten. We found many places where Fishers dug up the beechnut stores of squirrels, and they sometimes ate ferns, mosses and beech buds.

During early winter, Fishers feed on deer carcasses nearly every night, and naturalists have wondered whether they ever attack deer. It is possible. Male Fishers usually weigh between 5 and 12 pounds — probably big enough to deal with a small or weak deer — and some weigh as much as 18 pounds. Yet, there is just one record of a Fisher attacking an adult deer, and one account of an attack on a fawn.

JUNE 1964



We never found any signs of a Fisher killing a Porcupine, but the animals we trailed did prowl around the rocky areas where porkies lived. Fishers are best-known for their predation on Porcupines. This was first noted in 1829, when the Scottish naturalist John Richardson wrote (in *Fauna Boreali Americana*), "Its favourite food is the Canada Porcupine, which it kills by biting in the belly."

Through the years there have been several eyewitness accounts of Fisher attacks on Porcupines, and they agree with Richardson's early report. Fishers strike at the belly or throat of Porcupines, where there are no quills. One woodsman saw a Fisher climb after a Porcupine that was feeding in a tree. The predator swung under the limb to strike at the Porcupine's underside.

To the agile Fisher, a Porcupine represents an easy supply of 5 to 10 pounds of food. However, not all Fishers escape unharmed when they kill a Porcupine. A few have been found near death, infected from a faceful of quills. These deadly barbed objects are often found when trappers skin the Fishers they catch. Yet few Fishers are harmed by the quills. One biologist reported finding hundreds of them in a Fisher's intestinal tract, with no apparent ill effects on the animal. There is a hint that Fishers may be more resistant than other animals to the festering and inflammation caused by quills, but this theory would be hard to prove.

There has never been a successful experiment which showed that Fishers control Porcupine populations. One was attempted in Massachusetts, where a single Fisher was released on an island with about 50 Porcupines. The experiment ended a few months later when the Fisher disappeared, probably swimming a quarter-mile to the mainland.

A great deal of circumstantial evidence says that Fishers do kill enough Porcupines to control their numbers — evidence such as this one from an Adirondack native: "Twenty years ago, it was practically impossible to keep Porcupines from ruining our camp; now with the great increase of Fisher in the area, we seldom see a Porcupine."

Another bit of evidence comes from comparing Porcupine numbers in areas where Fishers are present with areas that lack them. New York

offers such a contrast: the Adirondacks have plenty of Fishers and few Porcupines, while the Catskills have no Fishers and are literally crawling with Porcupines. In 1954, two Catskill campers shot 34 porkies around their campsite in just three days. Porcupines sometimes chew on automobile tires and some Catskill natives protect their parked cars with a roll of chickenwire fencing. Dr. W. J. Hamilton, Jr., Professor Emeritus of Zoology at Cornell University, suggests that Fishers be stocked in the Catskills to help reduce the overabundant porkies.

Fishers used to live in the Catskills and in most of northern forested North America. The species ranged from coast to coast and far into the south in mountain timber. Fisher remains have been recovered from an Indian mound in Georgia, and there is also evidence that they once lived in Kentucky and the Carolinas.

As settlers cleared the forests by logging and fires, Fishers began to disappear in many areas. Even in wild habitat they were doomed by relentless trapping. Their fur brought high prices,

One of the Fishers released in Oregon's Rogue River National Forest. Just prior to release, each of the animals was given an ear-tag for future recognition.

Photo: American Forest Magazine

especially in the 1920s when choice pelts were worth about \$125 and a record high price of \$345 was paid. Trappers caught all they could and concentrated on tracking down the smaller, more valuable females. One by one, state after state reported that Fishers had been wiped out.

The Fisher's plight was worsened by a low reproductive rate. Females do not breed until the spring of their second year, and then bear one to five young the following spring. The gestation period is about 50 weeks, remarkably long for such a small animal.

By the 1930s, the Fisher had been labeled "headed for extinction" by many naturalists. A few strongholds remained: New York's central Adirondacks, and northern parts of Vermont, Maine, Minnesota and the Canadian provinces. Most of the states or provinces that still have Fishers eventually closed or limited their trapping seasons.

During the 1940s Fishers began to reappear in



some areas. Before long a tremendous comeback was underway. The species spread southward, reoccupying many of its former haunts in New England, New York, Ontario and Minnesota. Between 1951 and 1960 Fishers doubled their range in Maine. Today there are Fishers in southern Vermont and New Hampshire, within 200 miles of Manhattan. Before long Fishers may return to the Berkshires of Massachusetts.

Biologists are still puzzled about the cause of the Fisher comeback. In Ontario, data on fur catches from the Hudson's Bay Company indicate that the species is cyclic there, reaching peak numbers about every ten years. However, the current upsurge in Fisher numbers is too sustained and widespread to be part of a cycle. Most of the credit for the comeback goes to protective legislation and to the gradual recovery of forests from fires and intensive logging. However, some naturalists wonder whether the animal may be adapting to habitat that is less wild than the wilderness timber it is usually associated with.

There are, of course, huge areas of cleared and settled land where the Fisher can never return. However, there are also wild areas where Fishers were wiped out by overtrapping, and would be welcomed back as valuable furbearers and as a check on Porcupine numbers.

The first attempt to stock Fishers began in 1948, when Nova Scotia successfully re-established the species. Then in 1956 Wisconsin began importing Fishers from New York and Minnesota. So far, over 60 ear-tagged animals have been released in a 40,000-acre section of Nicolet National Forest. It is set aside as a "Fisher Wildlife Management Area," where the animals have complete protection. They are reproducing and scattering; untagged Fishers, presumably offspring of the tagged ones, have been captured many miles from the release point.

Since 1958, about a hundred Fishers have been flown from British Columbia to Montana, Oregon and Idaho. Montana concluded its stocking in 1960 and already reports some of the same signs of success as Wisconsin. It is too early to tell if the Fishers transplanted in Oregon and Idaho are surviving. Oregon released 24 animals in 1961 and Idaho ended their stocking in February, 1963.

Vermont never lost the Fisher as a native animal, but since 1959 the Department of Forests and Parks has introduced more than thirty animals from Maine as part of its Porcupine control project. They were released in areas with chronic Porcupine problems. Edward Walker, the biologist in charge of forest pest control, is hesitant to appraise the effect of the Fisher releases now. However, he says "There appears to be a definite decline in the complaints of Porcupine damage and the number of active dens in the Appalachian Gap area where we first released six Fishers in 1959. We credit the Fisher for this apparent decline in Porcupine population for lack of a better explanation."

The next ten years or so will be vitally important ones for the Fisher as a species. If the transplanted Fishers prosper, and if they reduce Porcupine numbers noticeably, many state conservation departments will consider stocking them. The species could return to many areas where it was wiped out decades ago. Judging from the reports so far, it seems to have a bright future.

An Exercise in Zoogeography

By HERNDON G. DOWLING

Curator of Reptiles

THE DIFFERENCES between the kinds of amphibians and reptiles that are found on Cuba and those on the adjacent mainland are so great that no herpetologist is needed to point them out. In Florida bullfrogs and their relatives share the roadside ditches with salamanders of many kinds, alligators bellow from swamps shared with rattlesnakes and water moccasins, while racers and ratsnakes abound in the woodlands. In Cuba, on the other side of the Florida Straits, no such animals are known. Instead, there are robber frogs and giant toads, boas and blind-snakes, and giant land iguanas.

The great divergence between the herpetological faunas of Cuba and Florida is not merely characteristic of that island and that state but is typical of the difference between the animal life of the West Indies and North America. The Bahamas to the east, which approach our shores even closer, have a smaller but equally distinct fauna.

Such differences in the composition of the animal life of two nearby areas suggest that the histories of the lands themselves are different. Biologists commonly lean on the knowledge of their geologist friends in such distributional problems but in the case of the West Indies the geologists have been singularly unhelpful. Rather than their data aiding an understanding of the animal distributions, they merely complicate it.

Neither the biologist nor the geologist has a great deal of information to work with and the varied interpolations from the scant facts tend to be farther apart than the facts themselves. To most herpetologists, at least, the West Indies are completely unknown. Only the continent of South America poses more questions of distribution and relationships.

The West Indian area is a huge one. Beginning just off the Peninsula of Yucatan, the island arc swings eastward and southward for 2,000

miles to end at the northeastern coast of South America. Hundreds of separate islands are included — from small rocks that barely project from the sea to the island of Cuba that contains more than 44,000 square miles.

The island arc is by no means uniform, either physically or geographically, and each island has its own geologic history. The Greater Antilles, Cuba, Jamaica, Hispaniola and Puerto Rico, are very complex geologically. Made up of various kinds of rocks, they are similar in structure to the mountain ranges of Central America. Trinidad, at the other end of the arc, is similar and is a part of the mainland that has been separated by the sea in relatively recent times — within the last eight to ten thousand years.

Between Trinidad and the Greater Antilles lie the much smaller islands of the Lesser Antilles, which actually form a double arc. The inner one, toward the Caribbean, is made up of volcanic islands that appear rather young, geologically speaking. They have high mountains and contrast with the low lying, apparently older, limestone and coral islands of the outer arc. These geologically "older" islands are scattered from Barbados, the easternmost of the West Indies, northward to include the Bahamas.

The reptile and amphibian faunas, though, show no correlation with this diverse geological background. Instead, the size of the island and its distance from the mainland, whatever its geologic history, appear to have the main effect. This strange lack of distinction between "old" and "young" islands in the Lesser Antilles has undoubtedly been influenced by the history of herpetological taxonomy. It used to be common practice to take each island as a unit and then to name each kind of animal on it as a separate "species," regardless of its evident relationships with similar animals on surrounding islands. This gave an erroneous aura of uniqueness to the fauna

that has not yet been corrected. Perhaps when the relationships of the various “species” are better worked out, a more detailed correlation of the biology and the geology of the islands will be revealed.

A close look at one of the simpler situations shows the problems encountered. Of the some 120 species of amphibians and reptiles in Florida and the 75 or so native to Cuba, only ten are found in both areas. It would appear from this that 185 amphibians and reptiles have been stopped by the 90-mile water gap of the Florida Straits. Actually, of course, this is not true, since not all Floridian amphibians and reptiles range down to the tip of the peninsula. The Straits do stop many — more than suggested by the figures.

When the ten species that range over both areas are considered individually, we find that their situations are highly different from one another. One, the bullfrog, we know was introduced purposely into Cuba during the present century. On the other hand, the broad geographic ranges and known powers of movement suggest that three of the others were dispersed by “natural” means, though not necessarily across the Straits. Lack of historical information on the other six places them in the no-man’s land of “probably introduced,” “possibly introduced” or “probably natural” distributions.

Another sort of historical lack is felt when the

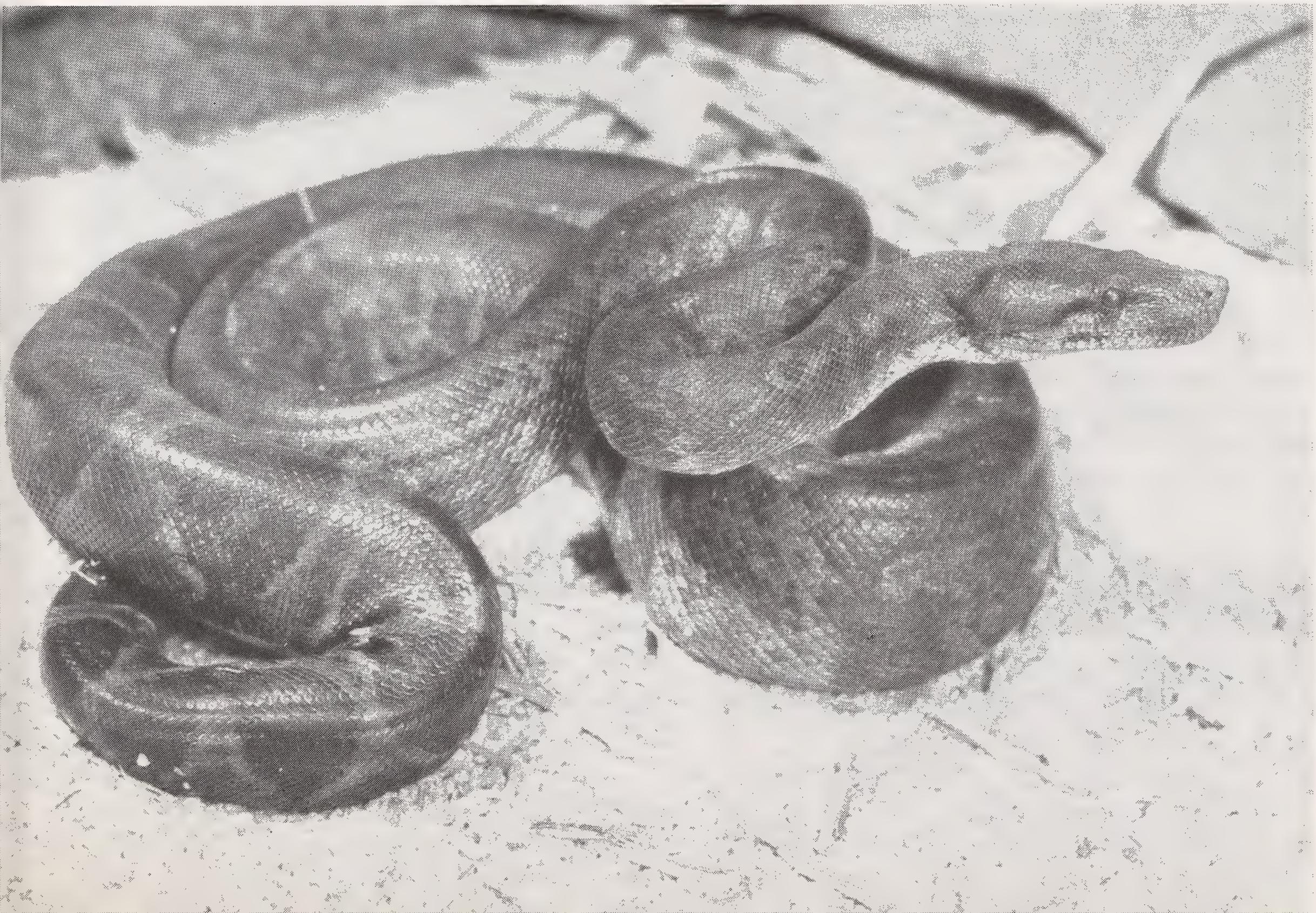
ARTIFICIAL VERSUS NATURAL INTRODUCTIONS OF
AMPHIBIANS AND REPTILES BETWEEN CUBA
AND FLORIDA

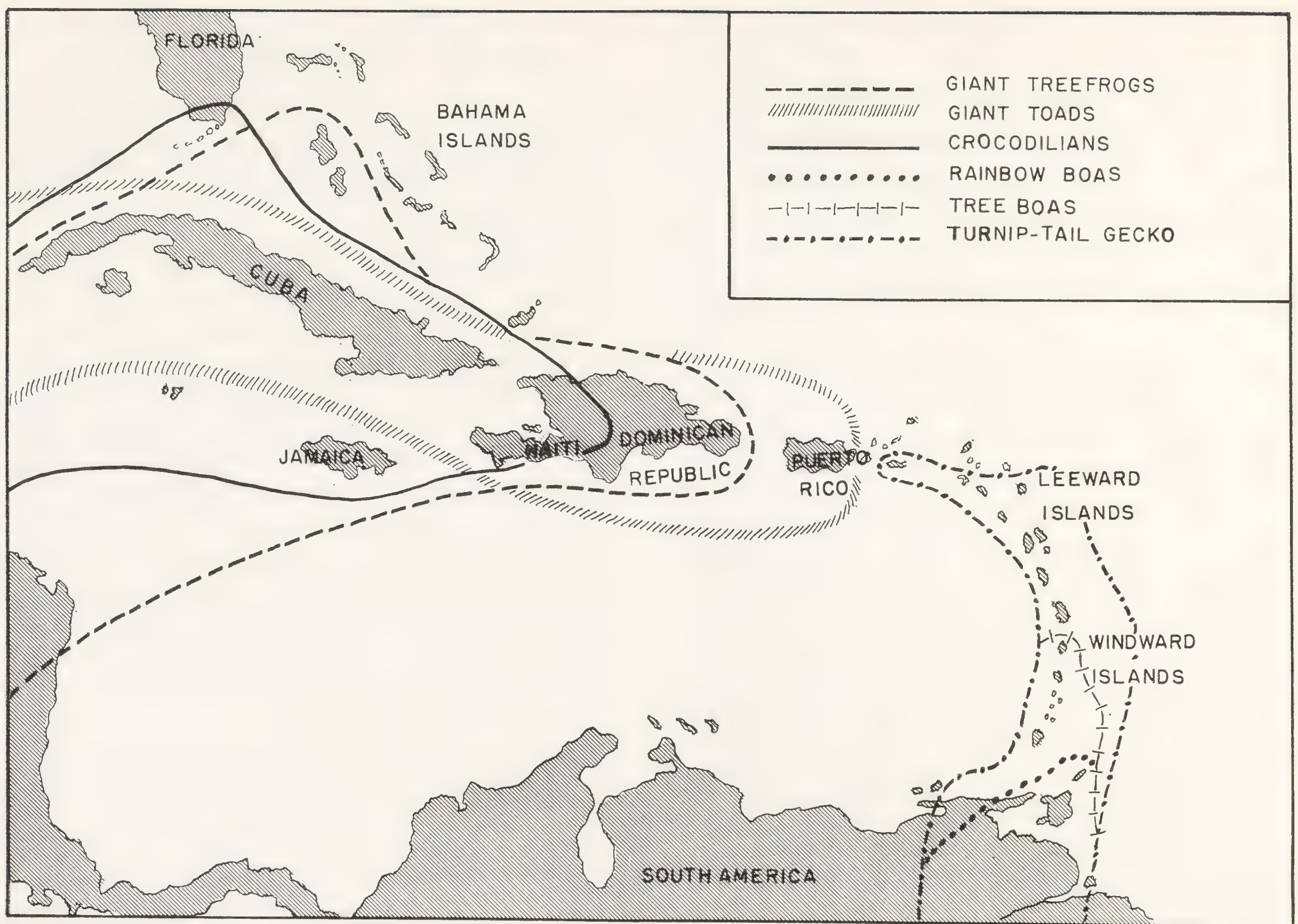
Introduced by Man	??	??	??	??	Natural Occurrence
Bullfrog ¹					
Greenhouse Frog					
Cuban Treefrog					
Ashy Gecko					
					Reef Gecko
					Key West Anole
					Mangrove Watersnake ¹
					American Crocodile
					Green Anole
					Pond Slider ²

¹ The only reptiles and amphibians to have gone from Florida to Cuba. The Bullfrog was recently introduced onto Cuba as a food animal.
² Although the same species of slider (or closely related species) occur in Florida and in Cuba, the actual passage was made via Central America.

constitution of the amphibian and reptile faunas of the Greater Antilles are considered. The geology of the islands is similar to the mountains of the mainland, but were they ever connected? Geologists are not willing to say and this leaves

The Dominica Boa, a relative of the mainland's Boa Constrictor, is found only on Dominica and Santa Lucia. This is one of the spotty distributions typical of the Lesser Antilles fauna.





The present distributions of some amphibians and reptiles show clearly their mode of entrance into the West Indies. Giant Treefrogs (*Hyla*) appear to have entered through Jamaica (4 species) to Hispaniola (4 sp.) and then to Cuba and the Bahamas (1 sp.). Giant Toads (*Bufo*) omitted Jamaica but reached Puerto Rico, and Crocodiles (*Crocodylus*) are found over the entire western area but extend only to Hispaniola in an eastward direction.

To the south, Rainbow Boas (*Epicrates*) are found only on Trinidad and Tobago, Tree Boas (*Corallus*) to St. Vincent, and the Turnip-tail Gecko (*Thecadactylus*), which may have had some human aid, all the way to the Virgin Islands.

the herpetologist with some very complex distributional problems to contend with alone.

If the islands were never connected with the mainland, how did such animals as burrowing worm-lizards and burrowing boas cross the open sea? If we admit that they may have been carried by some stray log or mass of tangled vegetation, then how is it that they were not accompanied by animals that are more easily carried by such "rafts"? What about all of the tree snakes in Central America?

On the other hand, if we insist that there must have been a land connection for burrowing animals to have crossed, even greater problems are raised. Why did neither the tropical worm-like amphibians (caecilians) nor salamanders make the crossing? Why are there no coralsnakes

and no pitvipers — and only a single pond turtle of all of the many kinds that inhabit the mainland? It is easy to see why biologists still look hopefully at geology to help solve these and many similar problems.

Only when we concentrate on relatively simple (and probably relatively recent) geographic distributions can we make reasonable zoogeographic sense of the West Indies. On looking at the map, we can see that there are five points where the island arc approaches the mainland and which might reasonably be used as gateways or "portals" to the West Indies. These are Florida-Bahamas, Florida-Cuba, Yucatan-Cuba, Honduras-Jamaica and Venezuela-Lesser Antilles. The distribution of various animals suggests that each of these has been used at least once.

It takes more than superficial geography to make a narrow water gap a portal, however. The swift-flowing Gulf Stream has essentially kept the Florida-Bahama and Florida-Cuba "portals" closed throughout the time that amphibians and reptiles have inhabited these areas. Only a single animal, the Mangrove Watersnake, has been able to make its way across the Straits to Cuba. All of the other "natural" or presumably natural penetrations of this formidable barrier have been in the other direction. And only one of these, the



The Rhinoceros Iguana of Hispaniola has relatives elsewhere in the Greater Antilles and the Bahamas and associated islets — but is not found in the Lesser Antilles or the mainland.



The Giant Cuban Anole — one of more than a hundred species of Anolis in the West Indies. Only one, the Green Anole, has naturally extended its range to the American mainland.

American Crocodile, has clearly crossed the strait.

The distribution of this crocodile (the same species inhabits the entire Caribbean coast of the mainland as well as the Greater Antilles) shows that either the Yucatan-Cuba or the Honduras-Jamaica portals has been "open" to such a strong-swimming and salt-water-resistant creature within recent times. However, it has as obviously been "closed" to most animals for a long time, since they have had time for their characteristics to change enough for them to be recognized as separate species, or even as separate genera, from their mainland relatives.

Only the Venezuela-Lesser Antilles portal differs from these. Here many of the species of the islands are identical to those on the mainland. Most of the animals have changed only slightly and an island form without a closely-allied mainland relative is a rarity.

This portal, though the Lesser Antilles, then, is the only one that is "open" at present. The Yucatan-Cuba and Honduras-Jamaica portals must have been open to most animals for the last time during the Pleistocene, when the accumulations of ice in northern regions lowered the sea level and brought the mainland shores nearer the island chain.

The herpetological faunas of Florida and Cuba, however, are as separate as though they were separated by a continent rather than a narrow channel of water. Such a barrier must have persisted for millions of years.

News from the Conservation Foundation

Encroachment on Estuaries and Tidal Marshlands

Man's tendency to congregate in regions where factors of climate, water supply and land fertility are most congenial creates a variety of resource-use problems. Seventy percent. of the world's population is crowded into areas totaling less than eight percent. of the world's land area. A high proportion of settlement is located close to the sea or adjacent to rivers navigable to the sea. Coastal marshlands and estuaries are particularly affected.

Encroachments on the Atlantic estuarine zone are of utmost importance. In April the Conservation Foundation initiated a 15-month survey by a task force of experts under the direction of Lionel Walford to assess the changes in and encroachments upon estuarine areas along the entire Atlantic coast. Dr. Walford is author of the book "Living Resources of the Sea," which was prepared under the sponsorship of the Foundation in 1958, and is Director of the Sandy Hook Marine Laboratory.

The project will encompass a full natural history survey including the mapping and inventory of resources. The interdisciplinary task force will undertake an assessment of the Atlantic estuarine zone's bio-geographical, historical, geographical and sociological aspects, thereby making possible for the first time a broader comparison of the Atlantic zone with similar zones in other regions.

Study Vegetation in the Azores

On May 1 Dr. Pierre Dansereau of the New York Botanical Garden began a one-year study sponsored by the Foundation of the exploitation of the Azorean landscape by plants of foreign origin, with particular emphasis on man's influences in the ecosystem of the islands. The Azores are an ideal site for such an examination of the behavior of induced species because there

are still considerable areas of nearly undisturbed vegetation for comparison.

Dr. Dansereau's assistants on the project are A. R. Pinto da Silva and his wife of Portugal and John Milton of the Foundation's staff. Preliminary field studies will be completed in May and June. It is expected that a series of technical articles will result from the study, in addition to a book on the state of conservation of natural vegetation in the islands. This will include discussion of the relationships between needed conservation measures and ecological theory.

Hugh J. Ross

The Foundation with deep sorrow notes the death of its comptroller, Hugh J. Ross, on April 5, 1964.

Briefly Noted

Samuel H. Ordway, Jr., participated as a discussant and prepared a statement, "Trends in Resource Administration," for a panel program at the 1964 National Conference on Public Administration . . . Mr. Ordway has been asked to serve on the Program Committee for the 30th North American Wildlife and Natural Resources Conference to be held in Washington in March, 1965 . . . William Vogt gave a talk on "The Outlook for the Twenty-first Century — An Overview" at the Food and Civilization Conference, sponsored by the Department of Continuing Education in Medicine and the Health Sciences of the University of California, in San Francisco on May 17 . . . F. Fraser Darling will be in New York in June to complete plans for the North American Wildlife Study Conference and conduct final surveys for the Foundation's study of National Parks . . . The Scientific Advisory Council will meet in New York on June 8 to evaluate the Foundation's current program and present ideas for new directions of Foundation effort. Expected to attend are Caryl P. Haskins, Stanley A. Cain, G. Evelyn Hutchinson, Paul B. Sears, Robert C. Cook, Carl O. Sauer and Abel Wolman.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM
AND THE DEPARTMENT OF TROPICAL RESEARCH

Society Moves to Protect Galapagos Fauna

In furtherance of its world-wide interest in conservation, the New York Zoological Society has undertaken the support of a Conservation Officer attached to the Charles Darwin Foundation's Research Station in the Galapagos. He is the first conservation official for the islands, and his work begins immediately.

A native Ecuadorian, Sr. Miguel Castro, has been appointed Conservation Officer. A long-time resident of the Galapagos, a guide and mentor of scientists visiting the islands since 1952, and a confirmed conservationist himself, Sr. Castro was selected by the late Dr. Victor Van Straelen, president of the Charles Darwin Foundation, just before his death this spring. Sr. Castro was known to Curator Dowling from two recent visits to the Galapagos, and Dr. Van Straelen had mentioned to the Zoological Society that he would be seeking financial support for the position of Conservation Officer. Three year's backing for Sr. Castro was voted by the Society's Executive Committee in late May.

The Conservation Officer's job will be the preservation of Galapagos fauna and flora throughout the archipelago, as a full-time job. It will include eradication of the introduced goats on certain uninhabited islands — one of the principal hazards to wildlife — as well as the protection of Galapagos Tortoise nesting sites and preservation of existing tortoises, iguanas and birds. As a native, well-known and respected in the islands, it is hoped that Sr. Castro will be able to make considerable headway in showing other islanders the need and the advantages of conservation.

Two New Belugas. Two female Belugas, or White Whales, were received by the Aquarium on May 16 as companions for the two males already on exhibition in the Oceanic Pool. The

newcomers were captured in a weir at Isle aux Coudres in the Gulf of St. Lawrence.

"Animals" Picture Book. Eighteen of the most striking animal photographs in the Society's collection, including three in color, have been reproduced in a new booklet, "Animals," published by the Society at the end of May. All but one of the photographs are the work of Staff Photographer Dunton. The booklet, 12 x 13 $\frac{3}{4}$ inches in size, has been placed on sale at the Zoological Park and the Aquarium at 50 cents.

A Year Late — but Welcome. More than a year ago the Bird Department ordered five Boat-billed Herons from a dealer in Costa Rica. No reply, and no herons, resulted, and so in the course of the next few months we bought Boat-bills from other sources as they came on the market. Late this spring we received a telephone call from one of the local airports — a box of birds had arrived, consigned to us. It was the Boat-bill Heron shipment from Costa Rica — five magnificent young specimens. In a few days we had a letter explaining the delay — our original order had been delivered to the wrong address but after a year reached the right one, and the dealer



The Inca Tern of the west coast of South America, with its curling white "sideburns," is a most engaging bird. We have 11 adults and now this youngster, the first we have hatched.



With heavy mechanized equipment and skilled crews from our own construction and maintenance departments, an enormous amount of work has been accomplished this spring in the areas around "Bird Walk" and the new Aquatic Bird House. New walks and lawns, new fences and grades, new planting, make this once-drab corner of the Zoo bright and attractive. Outside help was called in to enlarge and repave Fountain Circle Parking Field — but all other work was done by our men and equipment.



promptly filled it. So now we have ten Boat-billed Herons, somewhat more than we had expected to exhibit, but enough to make a most interesting exhibit in the new Aquatic Birds Building later this year.

The Jungle Yields. Animal rarities are going to have to go deeper and deeper into the wild if they expect to remain rarities. Last year the Reptile Department reported as "new to the collection" and of considerable rarity the Preto Sideneck Turtle, *Podocnemis cayennensis* from the upper Amazon Basin. In April of this year Dr. Dowling found Preto Sidenecks offered for sale in the local pet-turtle market. Animal collectors and dealers had found their way into the turtle's remote jungle.

Heads Motion Picture Section. Staff Photographer Dunton will be in charge of the Motion Picture section of the Biological Photographic Association's annual meeting in New York August 24-27.

No Feeding! In a continuing effort to stamp out miscellaneous feeding of the animals by visitors, keepers in all departments have been supplied with printed notices headed "You Have Been Seen Feeding an Animal," which they hand to the offenders. The notice explains that there are strict Park regulations against feeding, except for specified animals (elephants and, at certain times, sea lions), and that further violations will subject the offender to penalties.

Antarctic Studies. The Aquarium has received from the National Science Foundation approval of a grant of \$16,500 for continued studies on seal metabolism in Antarctica.

PUBLICATIONS OF INTEREST

OKEE. The Story of an Otter in the House. By Dorothy Wisbeski. 246 pp., photographs. Farrar, Straus & Co., New York, 1964. \$4.50.

As Curator Joseph A. Davis, Jr., says in his foreword to this engaging book, "Life with an otter is madness of a special kind." Most of us would prefer to read about an otter in the house than to have one. Mrs. Wisbeski writes with affection and forbearance of the cross she willingly bore. There is an especially delightful chapter on her meeting with our Curator Davis, an equally devoted lutra-lover.

THE MALAY ARCHIPELAGO. By Alfred Russel Wallace. A facsimile reprint of the last revised edition. 515 pages, paperback. Dover Publications, N. Y. \$2.00.

An inexpensive, but perfectly clear and readable, re-



The Zoo Terrace Buffet was opened this spring as a replacement for the ZooBar Restaurant in the center of the Zoo. Hot and cold foods and beer are dispensed at self-service counters.

print of one of the great classics of zoology, botany, anthropology and exploration.

THE LAND AND WILDLIFE OF AUSTRALIA. By David Bergamini and the Editors of *Life*. 198 pp., profusely illustrated in color and black-and-white. Time Inc., New York. \$3.95.

The 17th volume in the Life Nature Library series — and as beautifully illustrated and expertly written as all the others.

ACOUSTIC BEHAVIOUR OF ANIMALS. Edited by R. G. Busnel. xx + 933 pp., 415 illus., 65 tables. Elsevier Publishing Company, Amsterdam, 1963. \$35.00.

The scientific study of animal sounds is an infant science whose birth became an accomplished fact only with the advent of electronics. The sounds made by animals have held the interest of students of nature from earliest times but the formal, scientific study of sounds, their composition and significance has been crippled by human inability to analyze complex sound, and, for that matter, by the limited range of sensitivity of the human ear. One of the classic investigations in Zoology, the discovery by Spallanzani in the 18th century that bats use their ears to detect obstacles, was roundly ridiculed by some of the greatest zoological minds of the day because the sounds produced and heard by the bats lay well above the range of human hearing. Not until D. R. Griffin, a quarter of a century ago, detected and recorded these ultrasonic cries did Spallanzani's experimental findings acquire an explanation. Since then the sounds of bats — and of other species, both vertebrate and invertebrate — have been recorded and analyzed with growing intensity. To bioacoustics, and its fairy godmother, electronics, the study of animal behavior, in toto, owes a large debt.

This thick volume had its origin at the International Conference on Biological Acoustics, held in 1956. Twenty-four writers have contributed significant chapters ranging from methods and techniques to information theory, covering both vertebrate and invertebrate sounds under five main headings: I. Definitions and Techniques; II. General Aspects of Animal Acoustic Signals; III. Special Aspects of Animal Acoustics; IV. Emission and Reception of Sounds: Morphological,

Physiological and Physical Aspects; V. Acoustic Behavior. Those chapters written in other languages have been translated into English.

The subject matter has been separately indexed in three ways: a systematic list of species, a standard alphabetic index, and a glossarial index, to facilitate access to the inevitable proliferation of a growing science's terminology. Because the book has had so long a gestation, much of the work described by the authors has continued apace, and fifteen pages of addenda to various chapters are included. This is no book for the layman, but will be invaluable to the student of animal sounds. — J. A. D.

OUR SMALL NATIVE ANIMALS. Their Habits and Care. By Robert Snedigar. Revised and Enlarged Edition, 248 pp., many photographs and drawings. Dover Publications, New York, 1963. \$1.75.

An excellent handbook on the habits and captivity care of most of the native mammals, birds and reptiles likely to be kept as pets, first published in 1939 by the Curator of Reptiles of the Chicago Zoological Park, and now brought up to date. The fact that certain birds and mammals are discussed here should not be taken as an indication that it is legal to keep them as pets; State laws vary, but there are strict prohibitions against keeping most native mammals and birds in New York State.

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ANIMAL KINGDOM



THE MAGAZINE OF THE NEW YORK ZOOLOGICAL SOCIETY

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ANIMAL KINGDOM

Bulletin of the
New York
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A Unique Book

OUR SOCIETY has cause to celebrate one of the more notable events in its history — the publication of a book that can justifiably be classed as “the first of its kind and scope.”

This book, entitled “The Management of Wild Mammals in Captivity,” is the consequence of half a century of practical experience, as well as many years of arduous work spent in its preparation. The author, Lee S. Crandall, General Curator Emeritus at the New York Zoological Park, started his career there in 1908.

This collection of information concerning the care and treatment of wild animals in captive conditions stems not only from the knowledge gained by the author himself but is derived from extensive correspondence with personnel in other zoos both in this country and abroad, as well as prolonged study of existing reports and literature on the subject.

The scope of the book represents one of its most impressive values. It throws light upon the care, diets, life habits, longevities, and related data of 1,382 kinds of mammals ranging from elephants, giraffes, antelopes and carnivores to lesser creatures such as fruit bats, shrews, solenodons and platypuses.

Because so many aspects of wild animal care are included, it is expected that this book will be of significant value to many persons beside those who are involved in the management of zoos. It will prove of interest and use to veterinarians, animal nutritionists, medical and research laboratories maintaining animals, students of animal behavior, professional mammalogists, wildlife management experts, zoology students and conservationists.

Many years of personal association with the author justify the belief, shared by all who know him, in his unique qualifications for the writing of such a book — painstaking, observant, and meticulous in avoiding any statement unless certain of its validity. His modesty has resulted in his making occasional complaints to the effect that this book would not be the “last word,” as new knowledge is always to be gained. He seems to fail to recognize that this is true of any book on any subject. In completing this monumental task he has produced a volume that, through the long future, will be invaluable to all who are interested in wild animals and that may, in turn, serve as a foundation for future literature on this entire subject.

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THE SEA OTTERS OF POINT LOBOS. I

THE GUIDE BOOK calls it "The greatest meeting of land and water in the world;" the map, more prosaically, calls it Point Lobos, and it juts into the Pacific Ocean some 80 miles south of San Francisco. In an age of careless superlatives, the guide book phrase is easy to shrug off — unless you have been there. When we came upon it, artist John Schoenherr and I had been traveling westward for several weeks at a leisurely pace, I making a zoo man's holiday of it, visiting other zoos on the way, and Jack gathering photographic records of animals and habitats

for the fine animal paintings he creates and of bleak desert scenes to serve as models of extraterrestrial landscapes in the illustrations he produces for a science-fiction magazine. Our ultimate goal was to feast our sight on Sea Otters along the coast. Although Sea Otters have occurred from Washington to Baja California, the Monterrey area and particularly Point Lobos is one of the best places to see them. We saw the otters, and their story will appear in the next issue of *ANIMAL KINGDOM*, but Point Lobos Reserve itself is a place of such beauty and biological interest that



By JOSEPH A. DAVIS, JR. *Curator of Mammals*

Illustrations by JOHN SCHOENHERR

it deserves to be treated in some detail on its own merits.

Point Lobos Reserve State Park is a model of careful planning and continuing meticulous attention to its objectives. Minute in size for a state park (the Reserve comprises 354 acres, only about half again as large as the New York Zoological Park), strictly enforced regulations governing its use have preserved the wild character of the land. Vehicular roads are reduced to a minimum, and most of the park can be reached only by narrow footpaths which are seldom visi-



ble as you scan the landscape. Camping is forbidden, for even the most experienced camper cannot help leaving traces of his presence.

We were more fortunate than most visitors to the Reserve. Chuck Maddock, the Ranger at the entrance gate, broke into a broad grin when he heard that I came from the Bronx Zoo. He had grown up in New Jersey, and had visited the Zoo often. From this chance encounter came an invitation for Jack and me to stay as Chuck's guests at his home within the Reserve. This was the Whaler's Cottage, an ancient, low-slung structure almost hidden between two enormous Monterrey cypresses. The cottage floor tilted up noticeably at both ends, pried up by the inexorably growing roots of the trees outside, but a canted bed was a small price to pay for the companionship of two such magnificent trees.

Point Lobos is characterized by a mild year-round temperature, frequent fogs and high winds off the ocean. The most conspicuous testimonial to the winds is the rugged response of the cypresses, which have appealed to painters for so long. But other and more subtle effects can be seen. The weather is one. Grinnell and Linsdale, two zoologists who surveyed the site, remarked that by jutting into the sea the Point became nearly independent of the mainland's influence on its weather, so that the variations in one day's weather may be nearly as great as its range

Point Lobos is surprisingly small for such an important State Park — only about half again as large as the Bronx Zoo. Sea Otters may often be viewed in the bay at the lower right.



throughout an entire year. The Point Lobos fogs certainly enhance the esthetic qualities of the landscape, but we were fortunate in not having to cope with them during the period of our otter-watching.

The rocks of the point are of two kinds. A hard granite that can be seen at its most spectacular where the sea has carved it at Cypress Headland appears to be the basic rock of the point. At Sea Lion Point, where we spent most of our time, the rock is of a vastly different sort. Here it is a conglomerate of comparatively recent origin. Bits of the granite and other rocks, fallen into the sea and ground by waves and sand, have become mixed with sand and gravel of the shore and hardened into a weak sandstone. This conglomerate then rose above the waters to be eroded again into cliffs. The exposed surfaces look and feel like an overly sandy concrete fill, studded with oval stones of muted greens, purples and pinks and carved into bizarre hollows and projections. Within these jagged hollows Jack and I hid, observing the otters, until we discovered that we could expose ourselves to view without alarming them.

Flights of sea birds met our eyes almost constantly during our two days along the shore. Cormorants of two species, black silhouettes against the sea, kept a continuous shuttle up and down the coast, flying low above the water. Small groups of Brown Pelicans came by frequently, alternately flapping with slow, majestic strokes and gliding on stiffened wings. Pigeon Guillemots hurtled down from the cliff to bob in the water like small black and white ducks, or took flight in a frenzy of wingbeats that seemed at first to be more a valiant effort than successful flight. Occasionally after peering through the spotting scope for a while we would idly scan the shoreline rocks to rest our eyes. Often our attention was caught by a small scarlet bar resting horizontally against the dark rock. Scrutinized through binoculars the red bar would become a bill attached to a black Oystercatcher. Later, following the flight of one of these birds, we were still surprised at how instantly and completely the bird disappeared when it came to rest, save for the bill.

The offshore rocks harbor colonies of Steller's Sea Lions, the largest species of eared seal, and the deep, rumbling, belch-like calls of the males

were clearly audible over the sound of the surf. The smaller California Sea Lions were present in lesser numbers, mere remnants of a larger herd that had already left for its breeding and pupping grounds to the south. Occasionally Harbor Seals could be seen along the shore, but they were inconspicuous. The seals themselves are fascinating animals and would have repaid full-time study, but we were concentrating on the otters and our principal interest in the seals lay in their interactions with them.

The most conspicuous creatures inland were White-crowned Sparrows, which seemed to be everywhere in the brush, and California Ground Squirrels, large, dusty-brown mendicants that were most in evidence near the picnic grounds. Black-tail Deer could be seen, with patience, and on our second evening, as we returned from our otter-watching, we met a doe at close range, coming over a rise. Brush Rabbits were common, but only occasionally seen, and then just at the fringes of the dense, low growth that borders many of the trails. Inland from the point we found stands of predominantly pine forest, its trees festooned with growths reminiscent of the Spanish moss of the southeastern states. Delicate light gray-green strands of lace, most luxuriant where the fogs settle longest, these are lichens, not flowering plants like the Spanish moss. The effect is indescribably beautiful. The forest harbors Dusky-footed Woodrats, and their dens are a conspicuous feature of its landscape. Their dens, built and remodelled over generations and made principally of sticks and twigs, may rise to a height of several feet above the ground.

On the headland above Sea Lion Point the chaparral gives way to mats of bluff lettuce, fleshy plants that reminded me of the hen-and-chicks in my own rock garden, but with translucent pink upright stems rising from the leafy base. The bluff lettuce was in flower when we set up our watch on the Point, its yellow flowers surrounded by questing bees. With such a superabundance of natural beauty to lead the eye and the other senses on to closer attention, Point Lobos Reserve would be an inexhaustible source for wonder and delight even if there were no Sea Otters. But there were Sea Otters, and these were what we had come to observe.

(To be continued in the next number of Animal Kingdom)



Kakapos vary greatly in size, but a length of about two feet seems to be maximum. Wings and back are moss-green with mottling of black and brown — excellent protective colors.

*Photos courtesy Wild Life Division, New Zealand
Department of Internal Affairs*

Last Call For New Zealand's Ground Parrot

By DAL STIVENS

THE GERMAN NATURALIST crouching on the high spur of the Southern Alps of New Zealand saw suddenly what he had been waiting for . . . a procession of large parrots, ghostly green in the moonlight, moving one behind another across the deep snowdrifts and steep alpine ridges. They were feeding on berries and giving a passing peck at any root or twig that lay in the way. "I frequently saw them taking their nightly walks on the Alps," he wrote afterwards. "It was very amusing to watch."

Today a millionaire (warmly clad) could not command what Andreas Reischek saw in 1884 in the Dusky Sound region of the South Island. Presumably only one small pocket of Kakapos, or night parrots, persists today in the wild Fiordland of the South Island. Kakapo is the Maori name; it is pronounced "karkapo" and means parrot (kaka) of the night (po). Scientifically it is *Strigops habroptilus*.

Few creatures could have been more defense-

less than the large, ground-dwelling Kakapos against predatory man and the animals he introduced — stoats, weasels, rats, dogs, feral pigs and cats. New Zealand became separated from other land masses about 70 million years ago and no predatory mammals later made their way there. As a consequence at least five kinds of New Zealand birds abandoned flying — the Moas (now extinct), Kiwis, Takahes and Wekas (Rails) and the Kakapos. Flying birds possess obvious advantages in safety as well as food-gathering. But given a densely-forested subtropical and temperate habitat with plenty of food, and an absence of flesh-eating animals, even moderate-sized birds could safely become ground foragers and over the ages lose the power of flight.

About 600 years ago the Maoris made a New Zealand landfall in seven long canoes and brought with them dogs and rats. The greatest of the Moas, the eleven-foot-high *Dinornis maximus*, had died out before these Vikings of the Pacific landed. Their coming almost certainly hastened the extinction of some of the smaller Moas. All thirty species were extinct when white settlement began in the first half of the 19th century. Polynesian hunters and the dogs and the rats they brought with them considerably reduced the numbers of the Kakapos in the North Island and, probably, reduced their numbers in the South Island. The Maoris sought the Moas and Kakapos not only for their flesh but for their plumage, which was made into cloaks worn by chiefs of the highest rank.

What the Maoris had begun — they were conservationists to some extent, because tabus protected many creatures whose flesh or feathers were reserved for chiefs — the coming of the white man speeded up. Captain Cook on his second voyage in 1773 gave three pigs to a Maori in Queen Charlotte Sound. It was not long before North and South Islands were overrun by "Captain Cooks," as the white settlers were later to call the troublesome wild pigs. The foraging pigs further reduced the dwindling numbers of the Kakapos and almost certainly helped to wipe out in the North Island the Tuatara, a sole survivor of a group of ancient reptiles.

After Captain Cook came the whalers and sealers and then the settlers who introduced dogs, cats and European rats. White settlement was

intensive from about 1840. The settlers' axe and the fire-stick brought a rapid destruction or alteration of the habitat. By 1922 the forested areas of New Zealand had shrunk from forty million acres to eleven and a half million. This was possibly the greatest single factor in reducing the already diminished number of Kakapos. But there were others almost as harmful — killing for sport or for pest control, predation by introduced animals and competition from introduced animals and birds.

Kakapos were ruthlessly slaughtered for the cooking-pot, for profit from the sale of specimens to European museums, and for "sport." "One Kakapo is a plenteous meal for two men," runs one early account. Another described the firm flesh as exquisite.

Some introductions were lethal — stoats, weasels and ferrets, which effortlessly tracked down the flightless birds, the Takahes, the Kiwis, the Wekas, and the nearly flightless ground-dwelling Kakapos. Probably the European rats which competed with them for food were their greatest enemy. In 1907 the naturalist Richard Henry, one of the first conservationists in New Zealand, was recording from Resolution Island: "The rats are back after an absence of six years. They came to Pigeon Island some time ago, and lately I found they were all over the Sounds as well. The wekas' good times are over while the rats are here."

Introduced parasites and diseases may have also contributed to the Kakapos' decline. It is also possible that they were on the way out — as the Moas were — even before man came to New Zealand and that he merely hastened the process. We shall never know now and can only speculate. But we do know that 80 years ago their numbers were reasonably good, and today they are on the verge of extinction.

Little is known about the natural history of Kakapos. Many New Zealanders have heard of them only vaguely and confuse them with Kakas and Keas, two large, hook-billed, mostly ground-dwelling members of the parrot family, also from South Island. There have been almost no intensive or critical studies. We have only scanty, and sometimes conflicting accounts, mainly by early settlers and naturalists.

The Kakapos' last stronghold today is in the New Zealand Fiordland, a 3,000,000-acre wilder-



The Fiordland of South Island, New Zealand, is the home of what is believed to be the last remaining colony of Kakapos. Unsuccessful attempts were made in 1961 to establish a colony outside their natural habitat; research and protection in Fiordland may be their only hope.

ness not yet dominated by man. They are rare, if not extinct in the North Island. In Fiordland, where the great peaks go up to 10,000 feet or more and are always snow-capped and the rainfall is 200 inches a year, the slopes are heavily forested and conceal bluffs which are almost impossible for man to cross.

Kakapos are very variable in size but a length of about two feet seems to be maximum. They have stumpy, degenerate wings. Their wings and back are a rich moss-green varied with brown and flecked with black, and merging into a light yellowish-green below. They are mainly nocturnal; their mottled and flecked plumage provides superb protective covering while they hide up during the heat of the day in hollows and dens of moss at the feet of trees. They have black hairy feathers on each side of the beak and radiating wreaths of feathers around the eyes. These and their soft plumage give them a somewhat owl-like look and have won for them the local name of owl-parrot. It has been conjectured that the bristly feathers on the side of the beak may aid them in their nocturnal forays for food, much as the whiskers of a cat do. Or they may indicate when the birds can turn around in a narrow space.

Whether or not the Kakapos should be called flightless birds is doubtful. Normal flying birds have keels on the breast-bones to which the powerful flight muscles are attached. In the Kakapos these keels are reduced almost to the vanishing point. However, after they have climbed trees in search of food they can fly to earth on their stumpy wings. They are agile climbers, using feet and beak and balancing with their wings. They can also travel quickly downhill by alternately running and gliding.

One of the earliest scientific accounts of the Kakapos came out in 1852, when Dr. David Lyall published a long article in *Proceedings* of the Zoological Society of London. Another early account was by Sir Julius von Haast, published in the *Verhandlungen* of the Zoological Botanical Association of Vienna in 1863. The first time Sir Julius saw a Kakapo he was startled by its flightlessness or near flightlessness. He saw a large one in the daytime, ten feet from the ground in a native fuchsia tree (kotukutuku), and eating berries. When it saw him, it threw itself off the

tree as if it had been shot, and escaped under some large fragments of rock. Sir Julius wrote that it did not open its wings or use them in any way to break its fall. To discover whether the Kakapo would fly or flutter when pursued, he caught a large one and took it to an open place. When released the bird ran towards the nearest thicket, moving like a fowl at a speed which, because of its unwieldy body, surprised him.

The Wild Life Branch of the New Zealand Department of Internal Affairs captured a Kakapo in 1958, the first observed by scientists in many years. It was photographed and measured and then released. Placed in a tree, it flopped to the ground and made off.

The habitat of the Kakapos today is the great beech forests and sub-alpine slopes of Fiordland. At sunset they emerge from clefts or fissures in rocks, holes between the roots of decayed trees or natural openings between fragments of rocks and make their way through the forest to sub-alpine levels to feed on berries, nectar, snow-grass, moss, roots and seeds. They have occasionally been observed to snack off lizards and other small creatures. They are noisy feeders, croaking and muttering all the time. Sir Julius von Haast examined the crops of some and found that they were usually filled with minutely divided moss, in enormous quantities. The crops were greatly distended and sometimes so heavy that a single one weighed several ounces. Some indigestible fibre is passed in dry pellets. A characteristic of the birds is to chew up a mass of fibrous plant leaves and extract the juices; tangled skeins of the macerated material, popularly known as "chaws," are subsequently left dangling from the plants.

Kakapos are particularly fond of the long purple berries of the native fuchsia which flowers profusely, if briefly, each spring, and mountain slopes where these grow were called kakapo gardens in the early days. The rich berry crops may trigger off the reproduction cycle. At this time the birds grow very fat. Sir Julius was one of the first to note that the birds have much firm white fat.

When moving up to the sub-alpine levels to feed, the Kakapos travel well-defined tracks along the tops of spurs. Andeas Reischek, when exploring above Dusky Sound, saw them feeding on such tracks, pecking at small obstructions as



Bristly feathers on either side of the beak and a radiating wreath of feathers around the eyes give the Kakapo a rather owl-like appearance, so that a local name for the bird is "owl-parrot." This male Kakapo was kept at the Wild Life Division Reserve.

they passed, generally in single file. Thus the tracks are always kept clean. He also noted that they would travel over the surface of the frozen snow, and that in places where the scrub was so dense that the snow could not penetrate it, the Kakapos took advantage of this to live below where it was both dry and warm.

It has been reported that in their search for food after sunset, they frequently travel long distances, holing up wherever daylight overtakes them if unable to reach their "home" shelters. When spring sunshine reaches the Fiordland slopes, the Kakapos emerge early in the morning from their homes and select a hole in the sunshine where they crouch down and remain the whole day. There are also idyllic accounts from the early days of berry-heavy birds slumbering in the sunlight in their kakapo gardens.

Circumstances have made Kakapos a little more wary today but in those early days they were quite fearless. Reischek found three birds in dif-

ferent places sitting upon low silver-pine scrub. They took no notice of his approach until he had them safely in his hand, when they began to bite and scratch. Henry records the same thing, "They are simple, poor things, that know nothing of enemies. I met one sitting on a stick under a fern a few feet from the ground, and went up to have a talk with it. It looked at me more in wonder than fear, until I chuckled it under the chin, when it assumed a fierce attitude and protested in its hoarse voice. It made no attempt to get away but merely fell into a sleep."

Many of the Kakapos' habits are still a matter of conjecture. Henry, who probably made the greatest single contribution to our limited knowledge of the Kakapos, claimed that breeding takes place in alternate years and that there are no exceptions to this rule — either all mature birds breed or none at all. Melland, on the other hand, said he heard birds "drumming" in successive years. If Henry is correct, the breeding habits must be remarkable among birds. Another difference of opinion is found in descriptions of the birds' calls. The most characteristic call, a "drumming" or "booming" commonly heard before and during the breeding season, is said by Henry to be produced by the inflation of an air sac in the

throat which develops before the start of the breeding season and that, when fully inflated, it is nearly as big as the body. This statement has had no confirmation from other observers or from dissectors of the species. No one has ever seen a Kakapo "booming."

Kakapos mate in late November. The males move up to the sub-alpine slopes where low-growing shrubs bear plentiful crops of berries and begin to drum out their booming love songs to the solitary females in the forests below. These deep, slow, muffled notes somewhat resemble the melancholy cry of the bitterns. They are repeated five or six times and are said to be audible up to six miles. In the drumming season the males indulge in nightly challenges to each other and in luring brides from the ridges, often a mile apart.

Eggs are usually laid in January or February. The female lays two to four large white eggs almost two inches long in a nest usually in large crevices among tree roots, in dead trees or underground, and lined with powdered wood or the female's own feathers. Brooding appears to be mainly, if not entirely, the female's task. The smaller bird — presumed to be the female — is wholly responsible for incubation, the length of which is unknown. There are accounts of presumed females working so hard carrying food to the hungry brood that they become very thin, with bedraggled and worn feathers.

Under natural conditions the reproduction rate is probably low because, as Henry observed, many of the young ones died before they learned to forage for themselves.

There are some charming, if anthropomorphic, early accounts of the "affectionate nature" of the Kakapo as a pet. F. W. Hutton and James Drummond in *The Animals of New Zealand* say "Its intelligence commands respect, its helplessness sympathy, while its genial nature endears it to all who know it well. It repays kindness with gratitude, is as affectionate as a dog and as playful as a kitten." Earlier writers also dwelt upon these characteristics. One of the first Governors, Sir George Grey, said that its behavior towards friends was more that of a dog than a bird. Professor G. S. Sale has recorded that his pet Kakapo would run from the corner of a room, seize his hand with claw and beak, tumble over and over

it, just as a kitten would. It then rushed back again, so as to be invited to make another playful attack. He added that when pleased, it bounced about with its head twisted around, and its beak in the air, wishing, the Professor presumed, to see how things looked the wrong way up. The highest compliment it could pay to anyone was to nestle down on his head, ruffle out its feathers and lower its wings, fluttering them alternately and shaking its head from side to side. When it did that, he asserts, it was in a superlative state of enjoyment!

Have the Kakapos any future? The Wild Life Branch in the New Zealand Internal Affairs Department, after much arduous work, captured five Kakapos in 1961 and flew them north to its Kelvin Grove Farm at Masterton, north of Wellington, in an attempt to breed the birds and save them from possible extinction. Hopes were soon dashed by the discovery that all five were males and by the early death of four. The remaining bird, however, has thrived. On coming out at dark he runs up an inclined log to a tree, from tree to the roof of wire mesh, along this upside down and back to the ground, with amazing agility and precision. However, should a torch be switched on he scuttles back to his shelter in a dark corner on a ledge behind a dense screen of manuka (tea-tree) scrub.

In captivity the other Kakapos became listless and seemed to lose interest in everything, even in eating. The surviving bird is the direct opposite.

One strange fact has emerged from the Kakapo's relationships with some other birds which were first kept in the enclosures. They seem to live in fear of it. At night, when the Kakapo was on the move, pigeons and kingfishers would panic. On one such occasion a kingfisher killed itself against the wire mesh of the enclosure.

For the present, no more birds will be brought to the Wild Life Branch farm but intensive field research is being carried out in Fiordland. Breeding in an artificial environment may help, but protection in their wild habitat offers the only real and permanent hope. The difficulties of this approach are enormous, but it is certain that the heavy-bodied, ground-dwelling Kakapos are ill-fitted to survive without help in the new environment that man has brought to New Zealand.

Flat and Fast —

THE PANCAKE TORTOISE



By ARSENE EGLIS

Crevices that would offer no shelter for most tortoises are a secure refuge for the Pancake, which may be only an inch and a half thick.

IF THE EXCEPTION, by contrast, underscores the rule, the East African Pancake Tortoise, *Malacochersus tornieri*, certainly shows up its sister species in the subfamily Testudininae as slow and ungainly. This anomaly among turtles actually scurries away in lizard fashion when surprised in the field.

There are situations, of course, that force the other tortoises to abandon the slowpoke-in-armor stereotype with which the public associates them. The hefty Malagasy Radiated Tortoises have been seen to achieve respectable speeds while maneuvering about during their breeding season. Our own Desert Tortoises of the southwestern United States become accomplished in negotiating narrow ledges along the steep banks that hold their dens and the camouflage-minded South African Speckled Tortoises have depressed shells that offer but weak protection against carnivores.

But all these qualities are combined, exaggerated and refined in the Pancake Tortoise. While the Radiated's dash is never more than a frenzied lumbering, the Pancake Tortoise's slender legs take long strides with a peculiar jogging style that bespeaks efficiency in motion. Our Desert Tortoises never become more than skilled climbers, try as they may; the Pancake Tortoise is born an acrobat. The Speckled Tortoises at least have shells of uninterrupted bone. The bony shell of *tornieri* has fenestra, or holes, so large that it looks like the framework of a ship when the covering horny scutes are peeled off.

Because its shell bones are reduced to a thin latticework, a Pancake Tortoise can be compressed between the fingers. In the words of Joan Procter, who studied its shell structure, the animal when picked up "gives a boneless feeling which is uncanny."

The most untortoiselike anatomical aspect of this improbable reptile is its flatness, however. The shells of most tortoises are high, preventing roaming predators from applying leverage on them with their jaws. The Pancake Tortoise gets along with a tawny, cardboard-thin husk that is no more than an inch to an inch and a half high. The other dimensions of an average shell being six by four inches, the effect is that of a nicely browned flapjack. Hence the common name for the species.

The flatness and the softness of the shell are so pronounced in adults that the zoologists Tornier and Siebenrock, confronted with the first few specimens at the turn of the century, thought them to be sickly, rachitic exceptions, for no tortoise species so handicapped was likely to have survived predation.

How to explain then, that the Pancake Tortoises have managed to do so well in an unfriendly environment that includes such voracious predators as jackals, ratels and servals? In a nutshell, the answer is: they acquired speed and knew where they had to flee.

No other tortoise species has been shaped by its environment more than *tornieri* has. Finding themselves in East Africa, the ancestors of the Pancake Tortoises sought out what is literally an environmental niche in the rock crevices of the numerous hillocks that are typical of the East African plateau, and under flattish boulders. While the shells of those who came to the hillocks as adults were relatively high, the restricted living space began immediately to shape the shells of their offspring. The shells conformed to the crannies. The bone reduction and shell softening were a slightly later development.

The tortoise shell is more malleable than it looks. A baby Hermann's Tortoise, *Testudo hermanni*, which grew up in an artificial cranny with a pair of Pancake Tortoises in my collection, reached six inches in length but remained only one and a half inches high. Also, its shell appeared to expand in breathing. It is possible that Pancake Tortoises would revert to their ancestral form in ten generations or so, if kept in an environment giving them security — in other words, darkness — without a low-ceilinged hideaway.

But to the early Pancake Tortoises in East Africa, security was directly proportional to the

depth of the crevice housing them. Of course, they had to emerge for food, but those wandering farther than perhaps ten yards afield often did not come back. Speed in returning to the crevice was found to be essential in their survival, and natural selection weeded out the slowest ones.

These survival principles have dictated the behavior of the Pancake Tortoise ever since. The environment that shaped the species has also held it in check by restricting it to areas with suitable shelter.

As a result, the distribution of the Pancake Tortoise is spotty in its presently known range, which can be described roughly as a trapezoid with the following corners: in Kenya, Njoro and Malindi, and in Tanganyika, Tabora and Lindi. The Pancake Tortoise probably can be found deep in the Northern Frontier District and may even impinge on the Somali fauna in the northeast. It should be looked for in hilly upland savanna type of country studded with rocky outcroppings, or in areas where scattered boulders abound. Its ecology may be further characterized by sandy, arid soil, covered with thornbush. The preferred altitude of the species ranges from 1,000 to 6,000 feet, but some tortoises are encountered at lower elevations.

While the shells of those which came to the hillock, the tortoises lead a gregarious, yet cryptozoic life. They apparently prefer the early morning hours for venturing forth to graze the herbage around their retreats. I suspect that they do not pass up dead insects or even small rodents and birds, since they have been observed ingesting carrion in captivity. The specimens in my collection prefer the early evening hours for their repast.

They are lizardlike in their adeptness at climbing and in their choice of shelter; in fact, collecting them is much like looking for the rock-loving chuckwalla of our southwest. They have been found gathered under a flat stone topping a large, eight-foot-high boulder. Some have been found in such unlikely places as fissures located high up in towering rocks, and in vertical clefts on boulders — the tortoises had to climb the rock and slide down the cleft. Their flat shells enable them to flip over easily should they fall on their backs in their clambering.

Those in the fissure frustrate the collector's



The thinness of the Pancake Tortoise is especially noticeable beside a plump Moorish Tortoise, whose thickness is some protection against predator jaws.

efforts to remove them by "taking a deep breath," to quote Arthur Loveridge, principal investigator of the species. Thus expanded, the shell is wedged in the crevice.

The two types of shelter harboring Pancake Tortoises — the high-up rock fissure and the space under flat rocks on the ground — suggest that the animals scamper to the latter in an emergency, but clamber up the rock to spend the day.

What constitutes an emergency is not known, but it is assumed that grazing Pancake Tortoises will scurry off at any suspicious movement on the ground. They have no third eye to scan the sky for birds that prey on them. But a rayed pattern on their horn-colored carapaces breaks up the shell outline and makes them indistinguishable from above.

It is also not known how fast they travel in an emergency in their native habitat, but I once clocked a newly imported specimen that "ran" for a short distance at a speed of 58 feet a minute. For comparison, the approximate speed of a Moorish Tortoise is 15 feet a minute. In collections where they get used to being stared at and handled, Pancake Tortoises soon lose their sprinting habit.

But a pair of *tornieri*, captives in my collection for half a decade, are obviously ill at ease when

their shelter is removed from the enclosure and trot to it with dispatch when it is restored.

Their swift orientation, as well as that of other observed specimens, is remarkable. While in the open, they keep aware of directions and unerringly head for shelter when alarmed. The German herpetologist Robert Mertens placed his captive specimen in a pine thicket, away from its customary hideout, but the alert animal did not waste any time in purposefully heading back to it. This special talent of the Pancake Tortoise has without doubt been sharpened by natural selection.

Interestingly, the orientation and the flight reaction of the Pancake Tortoise are characteristic of the behavior of water turtles, which are easily triggered into a dive when approached while basking. Since tortoises derive from turtles, the Pancake Tortoises may be considered primitive also in their behavior. Their shells certainly seem primitive, or turtlelike.

While as captives Pancake Tortoises are unmindful of other tortoises, they are gregarious among themselves in the wild, where a suitable hideout is likely to contain more than one.

This is especially true of their breeding season, which in East Africa occurs in the winter. It is probable that breeding activity exposes the individuals so engaged to predation. At least the male is invariably swept off the female's back and upended upon her retreat into shelter. But, despite these dangers, the species maintains itself

with no more than one egg, deposited at a laying in July or August. The hatchling that emerges in the fall has a pronouncedly dome-shaped shell, as compared with the adults.

Since reproductively they are organized in what one might call microdemes — small isolated communities around rocky hillocks — Pancake Tortoises differ from population to population. But these micropopulations have not been bunched together geographically into groups of any subspecific significance, and probably cannot be. There are two varieties, which differ mainly in that the shell of one is sturdier and more narrowly built than that of the other and commoner variety, which has the typical “pancake-shaped” shell. The New York Zoological Society’s specimens, now on display at the Reptile House, are referable to the former group.

Arthur Loveridge described a new species, *M. procterae*, on the basis of a specimen from Ikikuyu, Tanganyika, but it has since been sub-

sumed under *tornieri* for lack of additional specimens. The type’s head scalation could be distinct if seen in a series; its shell is about twice as deep as that of a *tornieri* of the same size, and shows an unusual vertebral keel. The uniformly light carapace carries a black spot on each scute. The specimen was found on fairly level country, where a high shell is required for protection. The area has not been adequately studied to determine whether *procterae* is only a color variant of the nominate species.

Nowadays when many people go to Africa, it is worthwhile suggesting that if specimens of *Malacochersus* are obtained by Society members from the thornbush in the environs of Ikikuyu, they may help reerect this form. Further, anyone fortunate enough to trek through the Northern Frontier District should, with the appropriate caution, turn over likely-looking flat boulders. What they find may well extend the northern range of this imperfectly understood tortoise.

THE PETTABLE CATFISH

By CHRISTOPHER W. COATES

Director, New York Aquarium

FIXED PATTERNS of behavior are not confined to human beings. Anyone familiar with animals at large knows that they are likely to follow certain paths, usually of their own making. Hunters quite easily recognize deer trails through the forests, and the signs one sees along the roads, “Deer Crossing,” are familiar testimony of deer routine. Less obvious are the pathways of mice and rabbits and such small fry, but they are still there.

A new road across a deer path may not stop its use, but the animals will make detours to avoid more difficult obstacles. Their ways are not so set that they will just sit and starve when faced with interference or blocking.

Because of the nature of water, the behavior of its inhabitants is not so easily observed. Nevertheless, with its three-dimensional aspect and general movement, one would not expect fishes

to even try to establish pathways. The fact is that migrating fishes do frequently follow the exact routes followed in previous years, by whatever method they seem to find their way about. The story of eels and salmon returning to the site of their birth is too well known to need repeating.

Much of this migratory behavior seems to be built into animals, for one generation follows the route of all other generations without, sometimes, any older experienced leaders. This is instinctive or inherited behavior.

It would seem odd, however, that an acquired pattern of behavior can be so established in one individual fish that any deviation is not accepted, even at the risk of near starvation.

We have one such fish in the New York Aquarium now. This is a quite handsome Red-tailed Catfish, *Phractocephalus hemiliopterus*,

about ten inches long, which was given to us by a fancier in whose tank it had grown, and who no longer could find room for it.

The fish is strongly and prettily marked, grayish black on the back, creamy white below, with a rosy pink tail fin. It comes from north-eastern South America, and while it is not exactly a great rarity, there are not many about and therefore we were pleased to get it and planned to exhibit it.

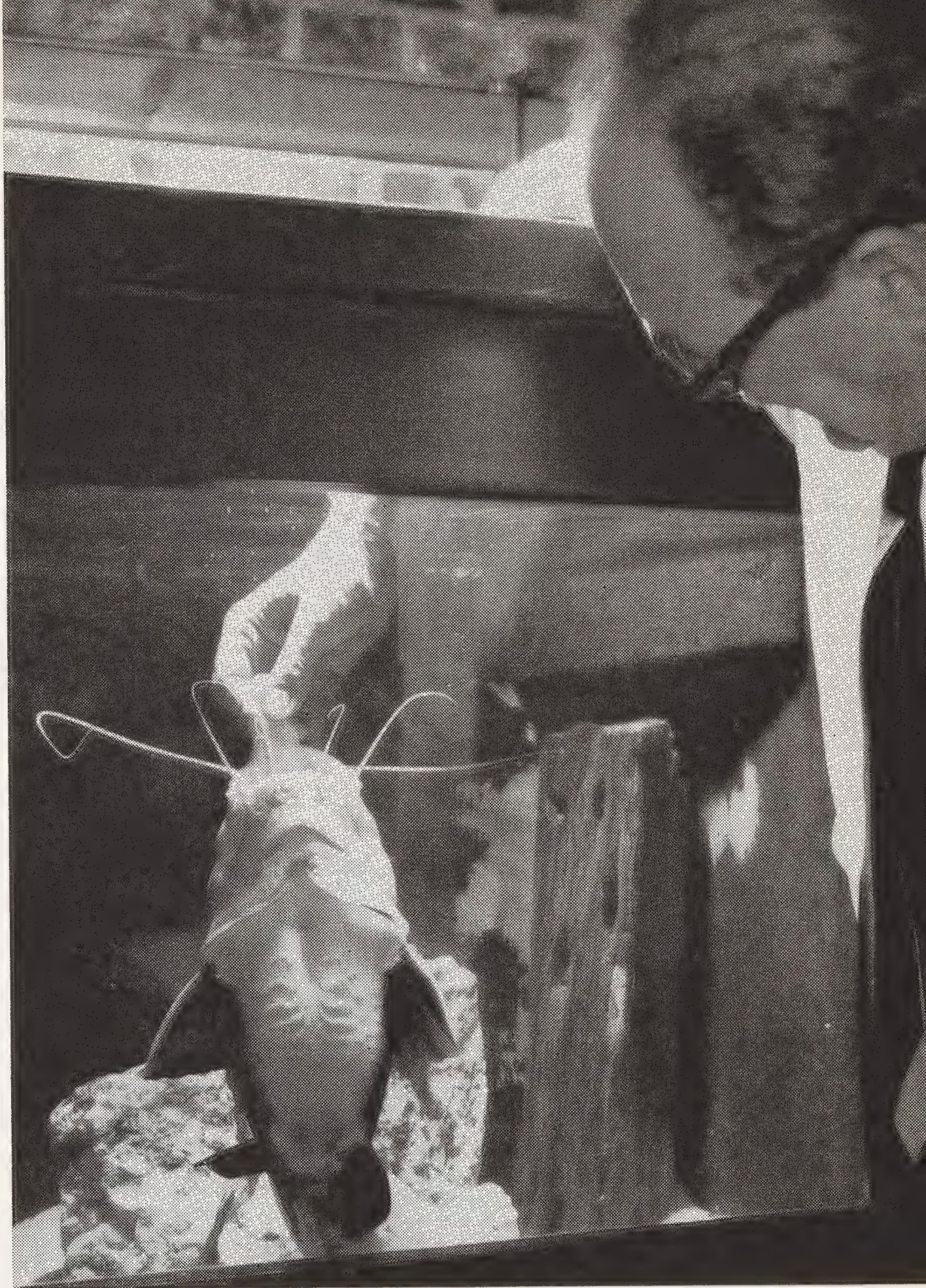
As it turned out, however, we were soon in danger of losing it. No matter what food we offered, it ate nothing. It looked well; the conditions under which we kept it seemed good; the food was all that any catfish would normally enjoy, yet it refused everything and was actually showing considerable thinning in its body. We talked to the former owner about it and she was as puzzled as we, for in her tank it had eaten voraciously all the foods we offered.

We were at a loss as to our next step when a casual remark started us in a new direction. The catfish liked to have its head scratched, the donor said, and she usually did this when she was feeding the creature. So we too scratched its head and offered food — and the food was accepted immediately! Any previously spurned food was taken readily as long as the head and back were scratched, and the fish did not seem to mind who did the scratching.

This fish has been on exhibition for several years, and has accepted the fact that sometimes its keeper is too busy to spend a great deal of time with it. He pats it casually, feeds it, and departs. This is enough, but the fish still likes to be fussed over and makes great play for attention as soon as the cover of its tank is lifted.

If it is hungry, a practically constant condition, it will almost swallow one's fingers along with the food, but though it has many sharp teeth it is always careful not to close down with them. There is no filling it up; if anyone happens along after it has been fed and offers it another bit of food, it will take the offering — as long as it is scratched and petted.

Once we put another catfish into the tank, a rare fish we wanted to exhibit, but although the Red-tail was larger and could easily have damaged the intruder, it did not. However, it ate less, sulked a bit, kept the new fish towards the



By scratching its head and at the same time offering a piece of food, this Red-tailed Catfish can be induced to eat. Fortunately, other fish in the Aquarium do not require such pampering.

back of the tank, and generally behaved badly. Scratching or petting, while accepted, did not stimulate any great excitement. After a week or so we removed the new fish and all was well with the old one.

One other curious fact seems to be established. The first ray of the dorsal and each pectoral fin of catfish is hard and sharp and capable of inflicting a quite serious wound. Our fish seems to take great care to keep these rays pointed away from the feeding hand, just as it never shuts its mouth if one's fingers are inside.

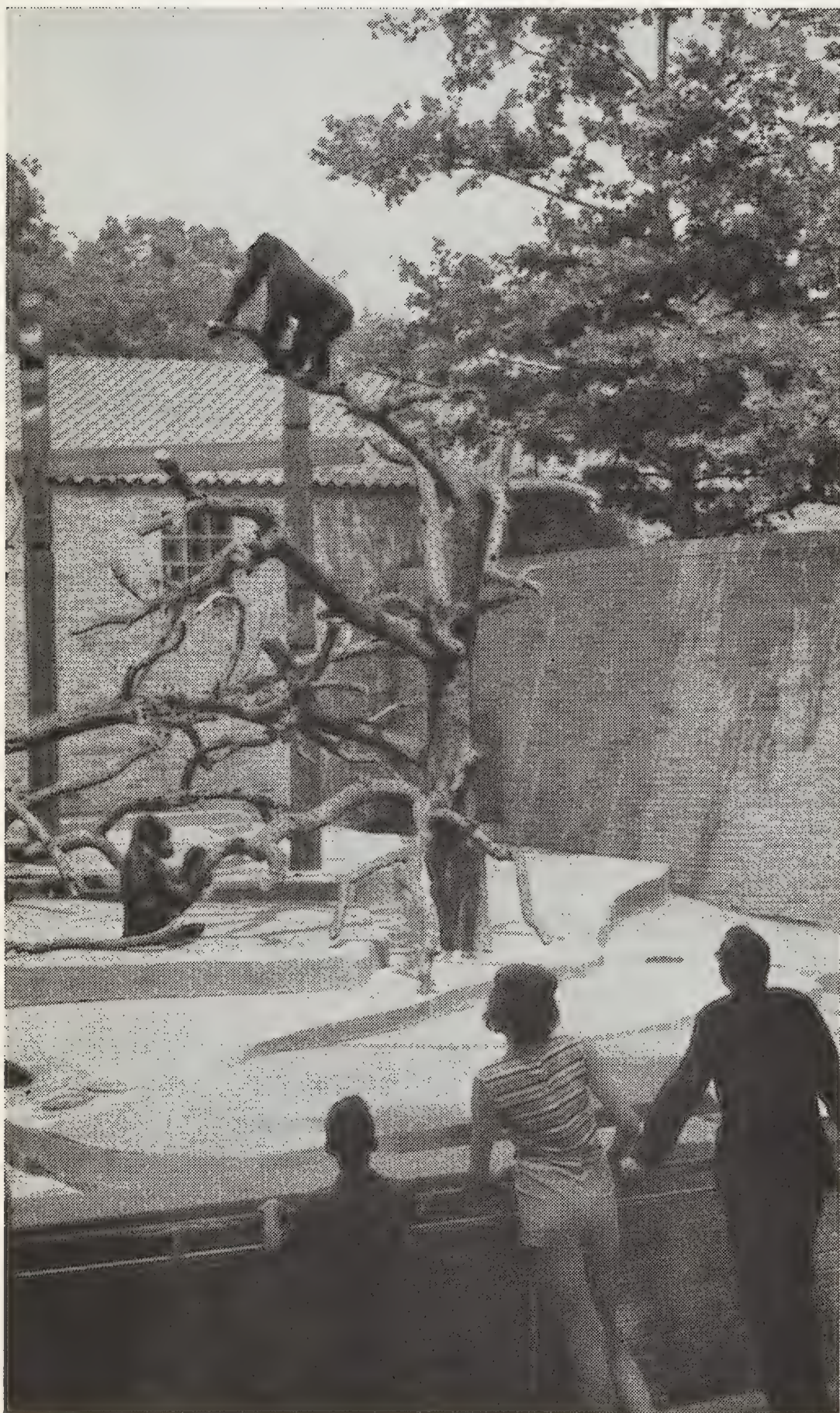
This is its present behavior. The original point, to emphasize, was that it had associated food with petting in so firm a pattern that when the petting was omitted all food was refused.

It would seem a fish can be just as "sot in his ways" as any human being.

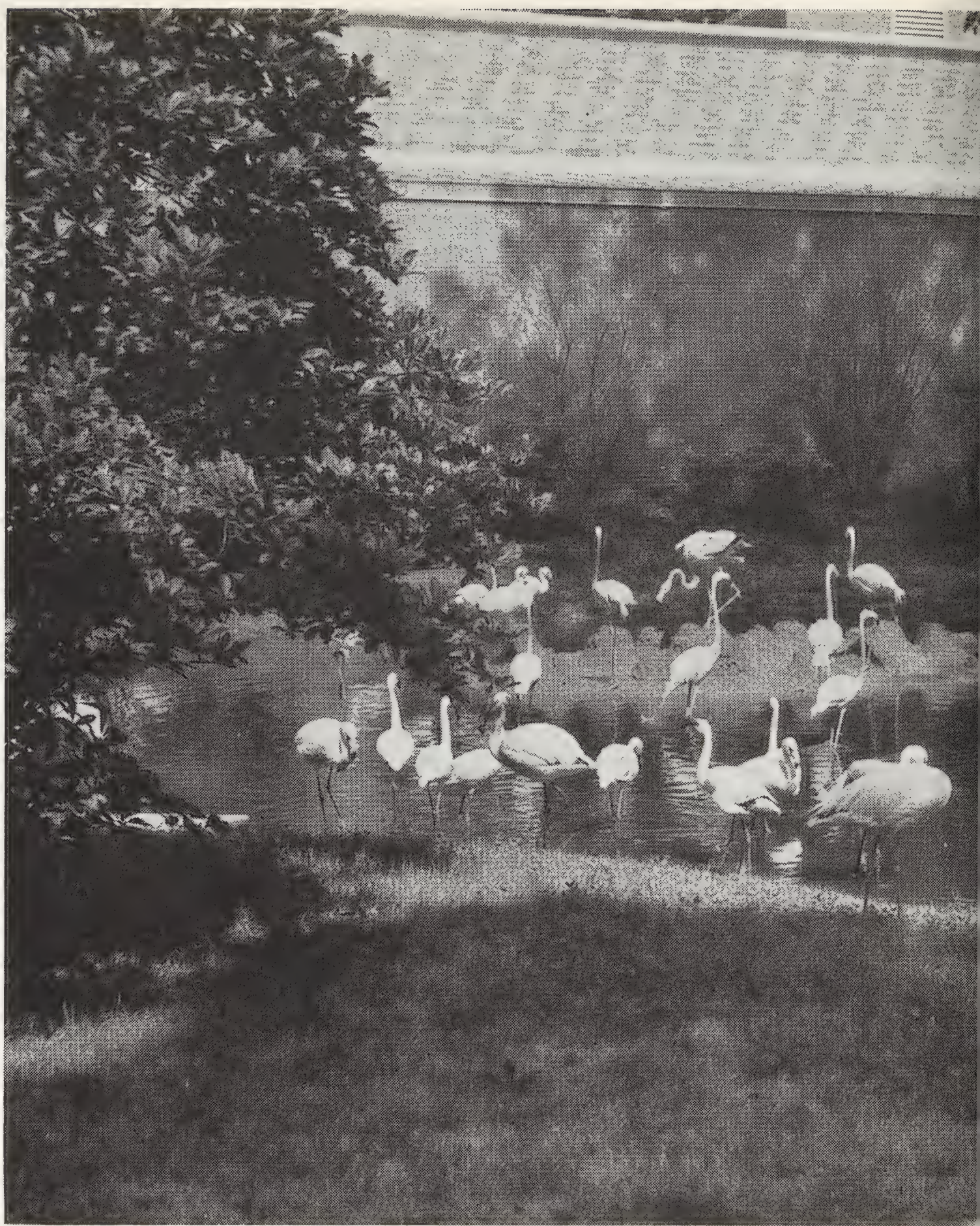
Around the Zoo and Aquarium

Photographs by SAM DUNTON

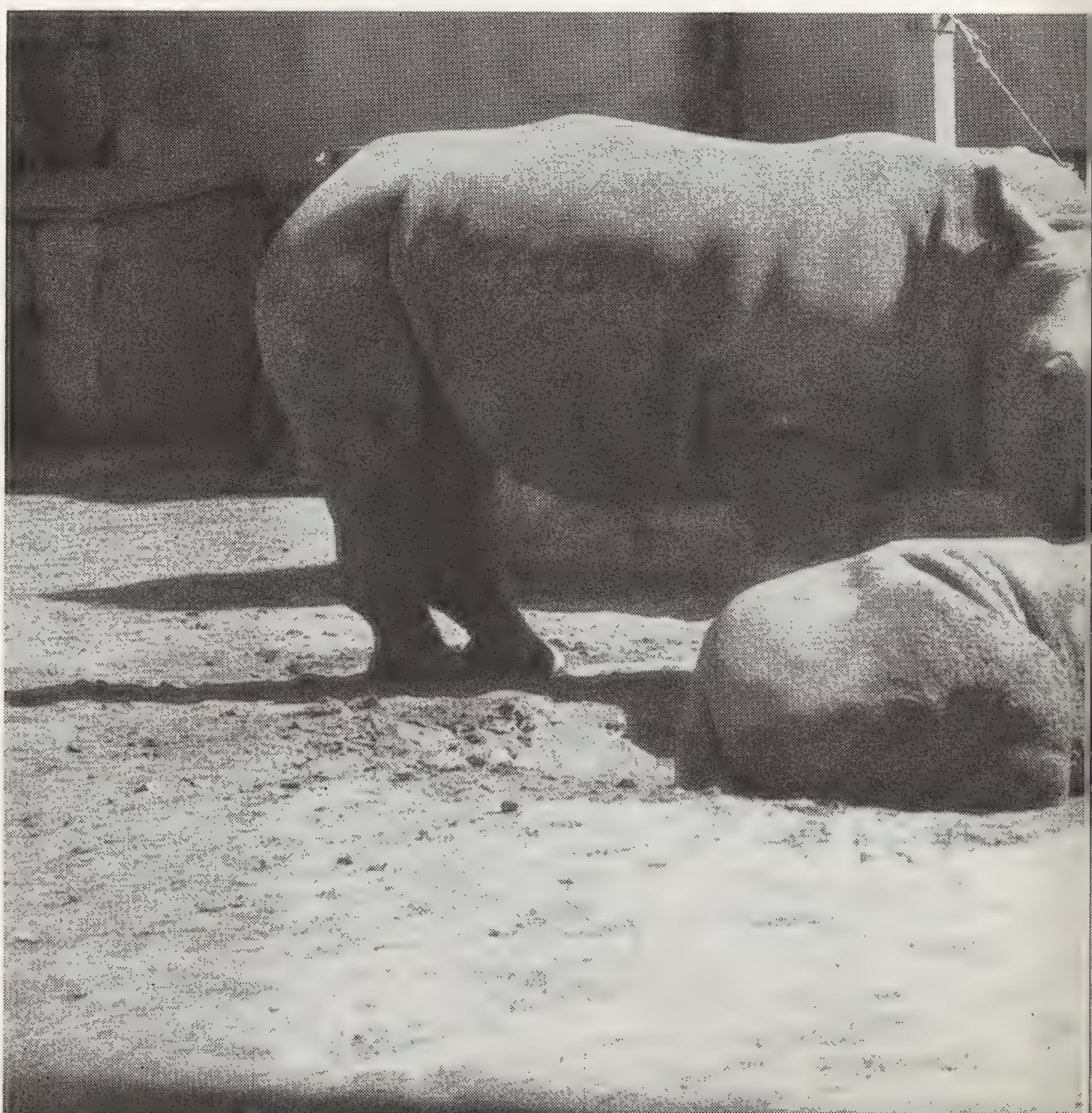
Staff Photographer



As a change from the carved perches provided in outdoor enclosures at the Great Apes House, we have now set up tall dead trees. Pili-pili, a Mountain Gorilla, took to them immediately.



Above — Our Flamingo collection comes “home” at last; here the birds inspect their refurbished pond and island outside the Aquatic Birds Exhibit which will be opened on Members’ Day this fall.

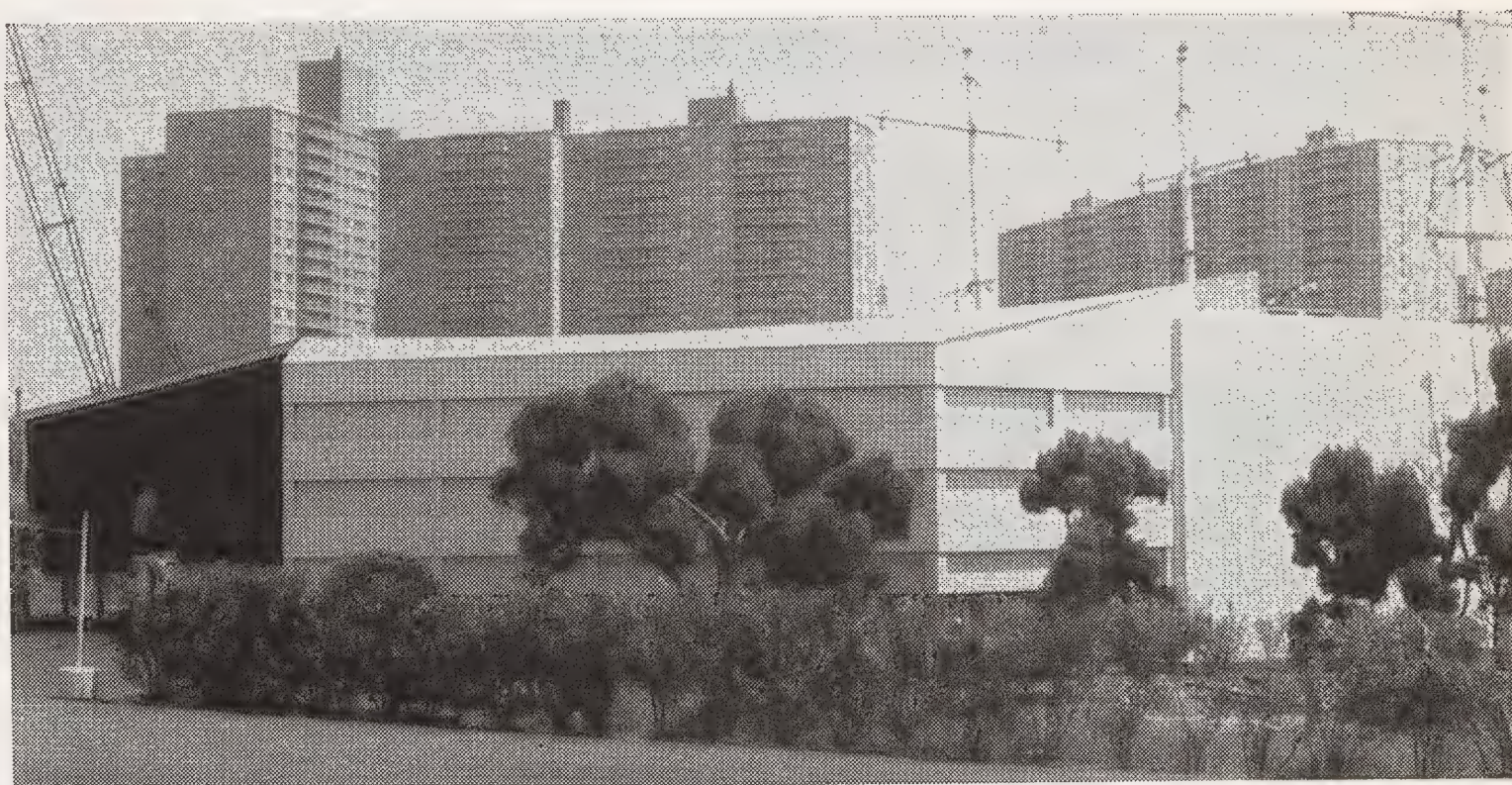




— White Rhinoceroses are well known to be f a mud bath and until lately ours had to tent with whatever puddles the rain cre- Now they have a real mudhole — and use it.



Bird Walk, the elevated passageway that runs diagonally through the big Flight Cage, is an excellent vantage point for watching the feeding of the birds on summer afternoons at 3:15.



*Above — Newest exhibit at the Aquarium is this building housing a tank 30 feet long, 18 feet wide and 7 feet deep, for the exhibition of a variety of local schooling fishes. Below — One of the new exhibits at the Aquarium is a Ghost Moray, *Muraena brummeri*, of the Indo-Pacific.*



An Appreciation of

AFRICAN RHINOCEROSES

By C. A. W. GUGGISBERG

Nairobi

PROBABLY NO ANIMAL, with the possible exception of the giraffe, has caused such wonder in the civilized world as the rhinoceros. The Romans may have been acquainted with the African rhinoceros, but 16th century Europeans only knew the one-horned, "armour-plated" Indian species. When travelers brought back accounts of two-horned African rhinoceroses, the artists illustrating their accounts obligingly drew animals with two horns on the nose, but with the "armour-plating" of the Indian Rhino. In 1653, Jan van Riebeck, the founder of the Dutch settlement at the Cape of Good Hope, noted rhinos as being common on the Cape Flats and the slopes of Table Mountain. James Bruce, the 18th century explorer of Abys-



sinia, saw the Black Rhino in the Sudan and gave a long account of its habits. At that time this species could be found over practically all the open plains, savannahs and bushlands from the Cape to the southern fringes of the Sahara, its area of distribution extending as far westwards as Lake Chad, northern Cameroon and northern Nigeria. It never occurred in the vast rain forests of West Africa and the Congo Basin, even though it is a common inhabitant of East African mountain forests.

At about the time that Bruce studied the Black Rhino in the Sudan, the existence of a second African species was vaguely hinted at by several South African travelers, but the White or Square-lipped Rhinoceros became definitely known only in 1817, through the efforts of William Burchell, the famous naturalist. He got his first specimen near Kuruman in 1812, and he described it in a scientific periodical after his return to Europe, naming it *Rhinoceros simus*, the blunt-nosed rhino, "from the flattened form of its nose and mouth." For a time the White Rhino was considered as sufficiently different from its black cousin — which had meanwhile had its name changed from *Rhinoceros bicornis* to *Diceros bicornis* — to merit inclusion in a separate genus, *Ceratotherium*. At present there is a tendency to consider *Ceratotherium* as a sub-genus only and to call the Square-lipped Rhino *Diceros simus*.

The White Rhino, being an exceptionally harmless and docile animal, simply lent itself to mass slaughter, and by the end of the 19th century it had become practically extinct in all Africa south of the Zambesi. Just as the species was being written off by most authors, a hitherto unknown area of distribution was discovered in western Uganda, the northern Congo and the southern Sudan. Shortly after the turn of the century a few specimens of the southern form were found to have survived in the Umfolozi area of Zululand. They were given complete protection and made a splendid recovery. There are now over 500 White Rhinos in the Umfolozi and Hluhluwe Reserves.

An alert Black Rhinoceros in the Serengeti National Park, investigating some suspicious circumstance. Its sight is poor, but the head is held high, ears are turned forward, nostrils sniff the tainted air.

All photos by the author.

Of the two African rhinos, the black one is the smaller, a large bull standing about 5 ft., 6 in. at the shoulder, as compared to a very big White Rhino's 6 ft., 6 in. The latter species may therefore be considered as the bulkiest land animal next to the elephant. Its color can be described as somewhat lighter than that of the Black Rhino, but it is by no means "white." The Square-lipped Rhino is a grazer and tends to carry its head very low. While the animal is slowly advancing, the broad mouth works like a lawn mower, literally cutting a lane through the grass. The Black Rhino usually carries its head high or only slightly inclined and feeds on branches, twigs, young leaves, roots, weeds and succulents, grasping the food with its pointed, prehensile upper lip. The branches, through which its teeth cut like garden shears, are often studded with thorns several inches long and so hard that they will serve as "ersatz" gramophone needles, but this does not affect the rhino in the least. It chews a mouthful of the most vicious thorns as if they were the tenderest of shoots.

Walking on an elephant track in the forest of Mount Meru in northern Tanganyika, the sound of a rhino chewing branches saved me from blundering right up against the animal, which was standing well hidden behind a thicket. The ominous sound sent me scrambling up a steep slope just before the rhino came round the bush. The ground being very wet, it slipped and completely overturned, thus giving me a very good start. I should like to mention that this particular rhino was fully justified in taking a dim view of human intruders, some natives having wounded it with a spear a few months previously.

While the White Rhino fell a victim to its inoffensive ways, the black species often came to grief because of its unpredictable temper. The animal's sight is very bad, but it hears well and has an acute sense of smell. A strange sound or a suspicious whiff make it rush forward in a ponderous effort to investigate. A man armed with a rifle usually considers such an advance as a charge, which means the death of one more rhino. If he has the nerve to hold his fire, the forward rush more often than not comes to a sudden halt. The rhino stands with its head high and swaying from side to side, ears forward, the nostrils sniffing the tainted air. Suddenly,



it turns around and lumbers off in the direction it came from, its little tail curled up like that of a pig. Having gone 30 or 40 yards, it runs in a half circle to the left or right and faces back toward the intruder for another sniff or two. After a few moments it completes the circle and continues its retreat. This manoeuvre may be repeated several times before the rhino is finally swallowed up by the bush.

Most encounters with Faru — as the rhino is called by the natives of East Africa — will terminate in this way. But occasionally an animal does charge, especially when the smell of a human being dimly reminds it of some painful and highly unpleasant experience. In 1685 Simon van der Stel, one of the Dutch governors at the Cape, had his traveling coach upset by a charging rhino, and since then the big, blundering pachyderm has acquired quite a reputation for running down people and scattering spans of trek oxen, for charging right through porter caravans and, more recently, for attacking railway engines and motor cars. Black Rhinos came to be known as “dangerous” animals and were shot at whenever there was an opportunity, a practice which,

White Rhinoceroses in the Umfolozi and Hluhluwe Reserves have recovered under protection; now there are more than 500 of them.

A Black Rhinoceros and her calf in Ngorongoro Crater. Typically the calf runs beside its mother and keeps a little to her rear.

of course, made them even more dangerous. It was only with the establishment of national parks and game reserves that man finally had a chance to get properly acquainted with Faru and to discover that it really is a very pathetic prehistoric creature, quite unable to adapt itself to modern times, and by no means the vicious brute it has been made out to be.

Unfortunately a new menace now arose to threaten the existence of the Black Rhino, still common in many parts of East and Central Africa. For centuries the Chinese and other oriental peoples have believed in the aphrodisiac properties of rhino horn. This ridiculous superstition is quite unfounded but it has already

brought the Asiatic rhinos to the verge of extinction. When Asiatic horns became increasingly rare, merchants switched their attention to Africa. Gangs of poachers were promised high rewards and an unprecedented slaughter of Black Rhino began. This is unfortunately still going on, for buyers are ready to pay fantastic sums for a few ounces of rhino horn. With Hongkong quotations at 80 shillings (1958) and 85 shillings (1959) per pound, poaching and smuggling have become a most lucrative business. Black Rhinos have almost gone from Cameroon and Nigeria, from the Chad and Ubangi areas, as well as from Uganda. They are disappearing from vast areas of Kenya and Tanganyika, the poachers even operating within game reserves and national parks. When elephants are shot at, they immediately leave the danger area, not to return for a long time. But rhinos are stubbornly sedentary, have very set habits and are thus extremely easy to find and to kill. Their protection must be awarded top priority among the many problems facing wild life conservationists in present day Africa.

One of the best areas to study Black Rhinos is the Amboseli Game Reserve at the foot of Mount Kilimanjaro, where these animals are easier to approach than almost anywhere else. Two rhino cows of Amboseli — known as Gladys and Gertie

to their friends — have achieved world fame in the course of the last seven or eight years. Both had exceptionally long front horns, and being very good natured animals who, in true rhino fashion, stuck to one small area, they have probably been photographed more often than any other individual animals in East Africa. They also made appearances in various motion pictures.

I first saw Gertie in March, 1954, together with a very small calf that had been born during the last quarter of the preceding year. This calf was a remarkable creature, for it had no external ears and only half a tail. Had Pixie, as the calf came to be known, been born like that? Or did hyenas get at her when she was very small? Nobody seems to know for certain. I have come across another calf without ears and with only half a tail in Ngorongoro Crater, and one is said to have been seen near Banagi in the Serengeti. Thomas Baines, the explorer, mentions an earless rhino encountered in what is now Southern Rhodesia. I am inclined to think that in all those cases the mutilations were present at birth and were not inflicted some time afterwards.

I saw Gertie and Pixie again in September, 1954, and got some good photographs of mother and daughter, even though they were not yet as tame as they became later on. On that safari I





met Gladys for the first time, and I marvelled at the size of her horn, which was quite a bit longer than Gertie's. Gladys had one ear hanging down, probably a souvenir of some battle, and she was accompanied by a calf. Her temper seemed somewhat frayed, for she chased Gertie and Pixie out of a clump of bush, this being the only incident of enmity between the two big cows I ever noticed. The Masai inhabiting the Amboseli Reserve always said that Gertie was the daughter of Gladys, and this may well have been so.

When I saw Gladys the next time, in October, 1955, she had lost the thin, up-curving tip of her horn, which was now shorter than Gertie's. The calf was still with her and she had, in addition, been joined by three older children, the five rhinos forming quite a formidable group. It is well known that White Rhinos tend to form small "herds" which may number from half a dozen to about fifteen animals. The Black Rhino is much less gregarious and mostly prefers to roam in solitude. If several individuals are met with together, they usually are a bull and a cow, a mother with calf, or a male, a female and a fairly big calf. Some authors have stated quite dogmatically that you will never see more than three Black Rhinos going together. The Amboseli animals show a definite tendency to congregate in groups, all members of which are probably

The much-photographed Gertie and her earless calf in the Amboseli Game Reserve. The calf, named Pixie, was born late in 1953 and besides lacking ears had half a normal tail.

more or less related to each other. Such groups may be formed around a cow of a certain age, as was the case with Gladys in 1955. But I have also known five to six youngish, though full-grown, animals to stick together for prolonged periods. Such a group was very much in evidence all through 1959 and 1960. The animals might wander off alone, in twos or three during day-time, but they always reassembled at about the same place for the night. One member of that group was our old friend Pixie, who, in 1955, was still sticking as close as possible to Gertie. Whenever she got accidentally separated from her mother, she uttered a plaintif "mfee — mfee," a most ludicrous little sound to come out of such a big animal.

In 1956 Gladys and Gertie had new calves in May and June respectively. I saw both offspring in September, the mothers being considerably more shy and nervous than they had been a year earlier, with their almost full grown calves tagging behind. Pixie, now almost four years old, had to fend for herself and looked pitifully forlorn.

I watched those new calves grow up in course of 1957, 1958 and 1959. When Gertie's calf was small, it did not like cars at all and usually took cover behind mother. Later, at the age of nearly three years, it once came trotting right up to my Land Rover, snorting defiantly. Suddenly it became frightened of its own courage and ran back to Gertie, who was placidly browsing not far away.

It has often been stated that a young Black Rhino always follows its mother, while a White Rhino calf precedes the cow, who directs its course by means of her horn. One should, however, not be dogmatic about what animals will "always do" or "never do." Both in the West Nile District of Uganda and in Zululand have I seen White Rhino calves follow behind mothers, even though I will admit that they more often walked ahead of her. A cow accompanied by a calf and a young but full grown animal, which

I surprised at a water hole in the Umfolozi Reserve, prodded both of them with her horn, which she afterwards used to guide them in the direction she wanted to go. I have seen less of the White Rhino than of the black species, but game rangers in Zululand told me that mothers frequently direct their young in that way.

Small Black Rhino calves sometimes run behind mother's broad stern, almost underneath her tail, more often at her side, though somewhat to the rear. Now and then they run ahead and I have photographs showing this. In February, 1959, I saw Gladys direct her three-year-old calf with her front horn, exactly as a White Rhino would have done. This is obviously not a common habit of the Black Rhino, for I have seen it only once, but it does happen occasionally.

In May, 1959, Gertie lost her spectacular horn. The major part of it was found and by fitting the pieces into a photograph blown up to life size, it was estimated that the horn must have measured $54\frac{1}{4}$ inches. In July — just over four years after the birth of her previous calf — she produced another offspring which, as usual, she kept hidden in dense bush for some time. In October of the same year, Gladys, too, lost her horn. Even though the two cows were not as photogenic as before, they had by then so endeared themselves to the visitors of the reserve that they remained Kenya's most popular tourist attraction next to the Nairobi National Park lions.

It came as a great shock, therefore, when in

Left — Gertie's abnormally long horn measured $54\frac{1}{4}$ inches, according to estimates made after she lost it. Below — Earless, short-tailed Pixie is spectacular in her own peculiar way.



January, 1962, while abnormally heavy rains interfered with the regular patrolling of the reserve, poor old Gladys was foully murdered by poachers. She was sincerely mourned by all who knew her.

Not long afterwards Gertie got into one of the usual rhino scraps and had an eye badly damaged. As it seemed to give her great discomfort, the game warden decided to have an operation performed on her. She was put to sleep, whereupon a veterinary surgeon carefully removed the damaged eye and stitched up the lid. When I visited her in October, 1962, Gertie had completely recovered and looked as fit as ever. At the time of writing (October, 1963), she is still doing fine. I saw her a few weeks ago, accompanied by her big calf and four other rhinos, with Pixie hovering around not far away. In the five years since she lost her weapon, some horny substance seems to have grown up from the fracture, but we can already be certain that the horn will never again reach anything like its former length and shape.

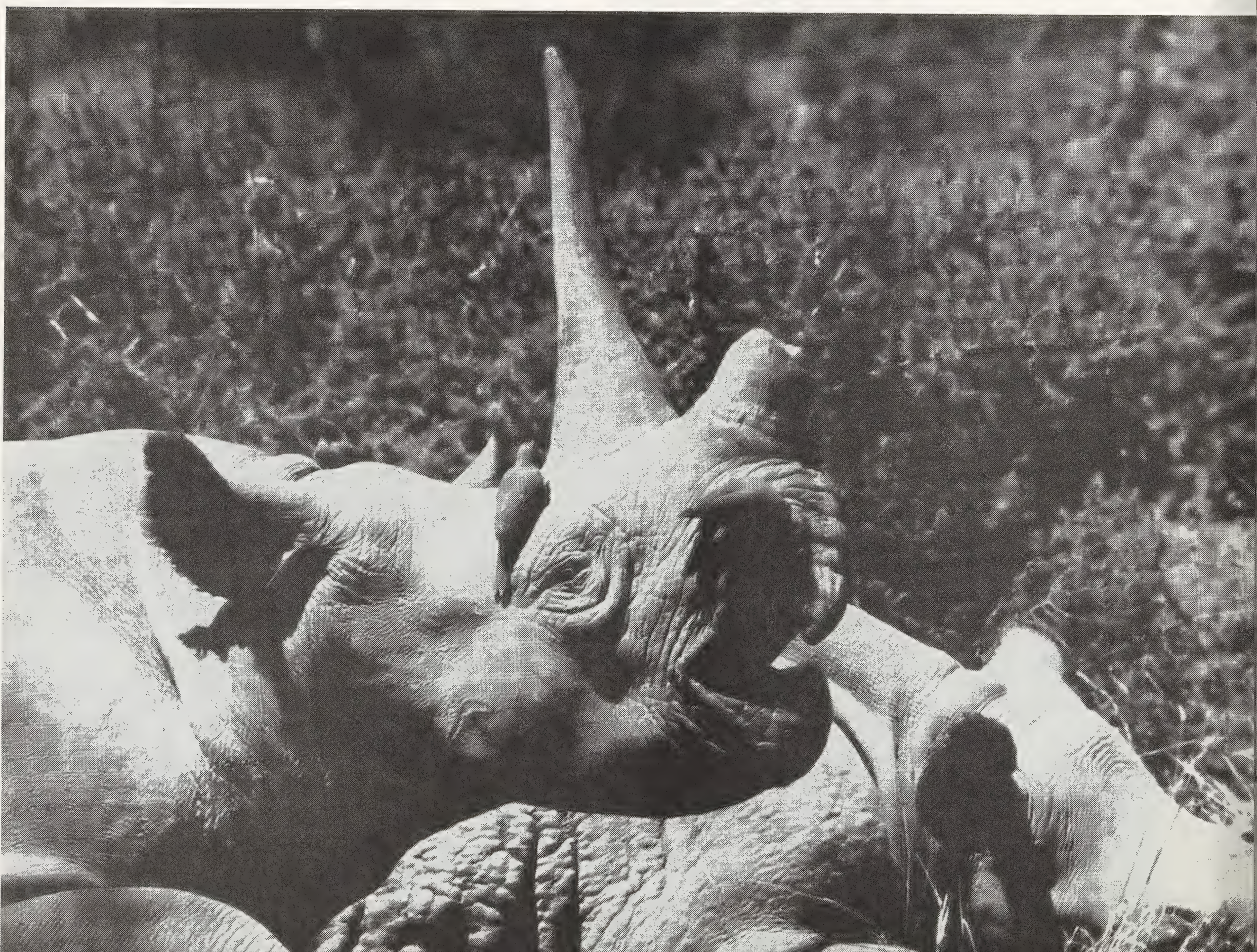
Rhino courtship is quite a noisy and boisterous affair, with the cow by no means entirely on the receiving end. It even looks as if she often had to stimulate the bull by means of violent attacks. In the Amboseli Reserve, early one morning, I saw a couple of rhino standing nose to nose,

puffing, swinging their heads from side to side, butting each other and scraping with their legs, throwing up enormous clouds of dust. The demonstration lasted for several minutes before one of the rhinos turned away and ambled off. In the Lake Manyara National Park I came upon a bull lumbering after a cow accompanied by a calf. She promptly turned round and went for him. The encounter was partly hidden by a thick bush, but there certainly was a considerable amount of snorting and snarling. Bulls sometimes fight over a cow that has come into season. Taking these rowdyish habits into consideration, one need not wonder at damaged ears and eyes, broken horns and the plentiful scars on a rhino's skin.

Rhinos drink regularly and they like to have a good wallow, often turning right over in the mud. This habit gives them the color of the soil predominant in their habitat, be it black, brick-red, or light gray. The "black" rhinos of Amboseli usually appear whiter than most "white" rhinos!

A rhino I saw coming to drink on several con-

This is Gertie after she lost the greater portion of her horn. Here — her prehensile upper lip obvious — she is trying to shrug off the Oxpeckers that have perched on her head and neck and are bothering her.





secutive evenings in the Tsavo National Park made itself a considerable nuisance to the other animals using the same watering place. One day it chased after a herd of waterbuck; on another occasion it drove away some buffalo before happily rolling in the mud. Whenever I have seen rhino and elephant in close proximity, the animals either ignored each other or the rhino beat an unwilling retreat. I was once shown the carcass of a rhino that had been gored and killed by an elephant; on the other hand I have heard of a rhino driving elephants away from a salt lick. At the famous Mzima Springs in the Tsavo National Park I saw a rhino which, in approaching the water at night, had collided with a hippo emerging from the pool for its nightly grazing. The hippo took umbrage, went for the rhino and killed it.

Rhinos are usually attended by whole flocks of Oxpeckers, red-billed birds which feed on the numerous ticks adhering to the thick skin. Cattle Egrets walk alongside the big animals, and snap up the insects which fly up under the ponderous tread. When the birds get tired, they fly up onto the rhino's back and let themselves be carried along. In the Hluhluwe reserve, where there are over 300 Black Rhino, I saw a Pied Crow perch on one of these animals.

Lions will kill a young rhino, if they get it away from a cow. This cannot happen too often, considering how tightly the calves hang on to mother's apron strings. Adult rhino and Lions are often found in close proximity and mostly pay no attention to each other. Photographs and movie films have, however, been taken in Ngo-

Famous family group in the Amboseli Reserve — Gladys, in the center with one ear hanging down, accompanied by a calf and several former offspring. A poacher killed her in 1962.

rongoro Crater, showing rhinos chasing away Lions, and a similar incident was recently observed in Nairobi National Park, when young Lions pestered a rhino which had left its usual haunt in the forest and come into the open plain. Just to keep us from setting up any hard and fast rules, two male Lions brought down a practically full grown rhino close to Ol Tukai Lodge in the Amboseli Reserve. They had not yet managed to kill it when the game warden drove them away, but one of the rhino's legs was broken and the animal had to be destroyed.

But man is quite definitely poor Faru's worst enemy. Of all East African game animals, the rhino is the least capable of adapting itself to intensive hunting. So let's stop hunting it for "sport" — it can, after all, be killed as easily as a cow, and who would like to have himself photographed grinning inanely over a cow he has shot? We must give full legal protection to the Black Rhino and put a ban on ownership and export of rhino trophies of any kind. After that, an all-out effort on an international basis will have to be made in order to deal effectively and adequately with the poachers and their slimy backers, who line their pockets in the process of destroying an interesting relic of past ages. It is our duty to save and preserve this short-tempered, prehistorically stupid but nevertheless so immensely lovable creature.

A Basic Zoo Manual at Last!

By WILLIAM G. CONWAY

Director of the Zoological Park

THE MANAGEMENT OF WILD MAMMALS IN CAPTIVITY. By Lee S. Crandall. 784 pp., 10 photographs in black-and-white. The University of Chicago Press, 1964. \$13.50.

BASIC contributions in any scientific field are naturally rare and worthy of special notice. The fact that a basic — more accurately, *the* basic — written work in the Zoo field has just been published establishes something of a paradox. But while the practice of keeping wild animals in captivity is almost as old as man himself, the modern science of zoo-keeping is not much older than the 56 years the New York Zoological Society's Lee S. Crandall has devoted to wild animal care at the Bronx Zoo. The present product of these zoo years is a monumental book modestly entitled "The Management of Wild Mammals in Captivity."

Surely there is not a zoo man anywhere who would fail to associate the words "Bronx Zoo" with the name "Lee Crandall" and every long-time reader of *Animal Kingdom* will find a résumé of his work and career an insult to memory. Yet, for the record, let me note that Mr. Crandall began working at the Zoo in 1908 as a student in the Department of Birds, became Curator of Birds and, eventually, General Curator. In theory he retired in 1952; in fact he will be in the Zoo at nine o'clock tomorrow morning as on most other mornings since 1908. He has left the Zoo to look at other zoos and to carry out collecting expeditions and for very little else. In 1917 he published "Pets: Their History and Care," and in 1931, "Paradise Quest," a tale of bird of paradise collecting adventures in New Guinea. Between times he has written some two hundred scientific and popular articles on birds and mammals, and like zoo men everywhere he has tried to learn personally as much written and unwritten zoo lore as possible. Unlike most of us, his disconcertingly accurate memory is matched by the depths of his curiosity, and thus the Zoologi-

cal Society found itself with an unusual combination and opportunity on Mr. Crandall's "retirement." Unique experience, ability and time. Mr. Crandall was put to work immediately. He set out to meet the great need for a written work on the care of wild mammals in captivity, to record the basic information gleaned around the world but uncompiled from zoo annals, and to report this information in the light of his own unparalleled experience.

In describing the present book, it is a little hard not to resort to the carefully considered organization of the work itself. I might say, for example, that "The Management of Wild Mammals in Captivity" measures 6¾ inches wide, 9½ inches high and 2 inches thick. It weighs 3.27 pounds and has 784 pages. It includes a table of contents and an index and the body of the work is systematically arranged by Families. Each Order's section is completed by references. But this skeleton must be fleshed out by an incredibly full array of facts, and — delightfully — the body of the work turns out to be engrossing reading for professional and layman alike.

This readability in what, on the surface, would appear to be a rather technical work so surprised me that I attempted to analyze it. Admittedly, lions and elephants, giraffes and platypuses, are of interest in themselves, especially to the technician; for the layman, the liberal sprinkling of anecdotes is an unexpected dessert. But it seems to me that the readable element goes beyond Mr. Crandall's proficiency as a writer and his engaging style, and lies in the fact that he has been personally involved in the care of the great majority of the creatures he discusses. This personal familiarity, so rare in technical compendiums, tends to pull together an essentially diverse and immensely complex body of information.

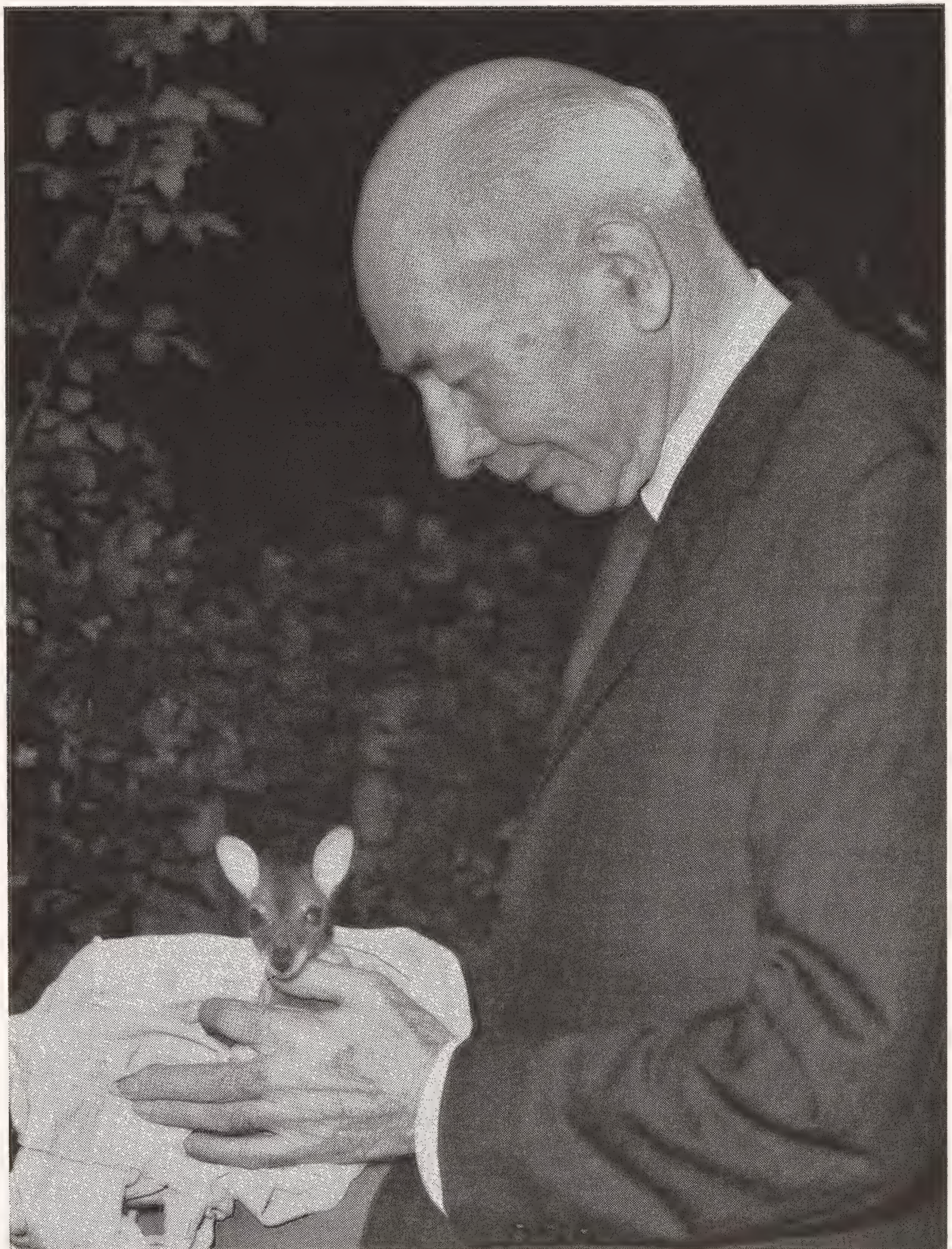
Two incidents in Mr. Crandall's personal experience are indicative of its scope. On page 3

he reports on a remarkable Australian Echidna which lived at the Philadelphia Zoo in an admittedly unattractive cage within the shelter of a wooden box — where it was probably content and certainly seldom seen for 49 years, 5 months and 15 days. Mr. Crandall comments: "I saw this echidna first in 1909, a feat accomplished by inserting my index finger through the cage bars and gently lifting the lid of the sleeping box. I repeated the act for the last time on April 13, 1951, the only noticeable change during the 42-year interval being the slightly increased resistance of the rusting lid hinges. Few zoo animals can enjoy such prolonged seclusion." Later Mr. Crandall in a discussion of African forest elephants comments in regard to our first of this race: "Congo was an ill-natured little creature,

fully controllable only by 'Alice,' a steady Indian elephant cow who had adopted him. He once nearly succeeded in impaling me on his slender tusks, between which, at the last instant, I managed to slip."

Information is presented species by species but it is not repetitive of similar facts for similar forms. Rather, Mr. Crandall has skillfully combined the generalities of each genus, subfamily or other appropriate group, and then separated out the most interesting distinguishing features of species life history, captivity history, breeding biology, physical characteristics and so on.

Contrasts repeatedly strike one and open new vistas to the researcher. Why, for example, do young Chinese Water Deer simply become lost if they wander away from their mothers, while



Not every young Agile Wallaby can look back on the distinction of being held by Lee S. Crandall, whose book on "The Management of Wild Mammals in Captivity" has just appeared!

young Muntjacs seem to be able to wander and return with little difficulty?

While Mr. Crandall has varied his approach according to the requirements of the groups he treats, each account includes, in addition to deft summaries of distinguishing physical characters, measurements and weights where available, range, habitat and comments on the wild biology and status of the species. Naturally, the concentration is upon those features of the known biology which are likely to be of importance in maintaining the species in captivity, and herein the meat of the book lies. Carefully documented histories are presented of individual specimens under captive conditions, their behavior and breeding biology. Observations are combined with widely gathered facts on gestation periods, parent-offspring relationship, diet, longevities, evidences for seasonal and periodic behavior, growth, development, temperament, family relationships, relationships with man and, where appropriate, economic importance.

Where an exotic species has been introduced into a new habitat, Mr. Crandall has sought to note it. Where a definite record of some physical feat has been obtained (an Ibex is capable of clearing a 12-foot fence . . . but usually doesn't) he has recorded it. He has done us great service by recording and documenting acceptable maximum size and longevity records. Some of these are from the wild, such as that of the largest African Elephant, which weighed 14,641 pounds, and some are records of captive animals, such as that of a Kadiak Bear in the Colorado Springs Zoo which weighed 1,670 pounds.

The importance of "The Management of Wild Mammals in Captivity" extends far beyond the borders of the world's few hundred zoos and beyond the curiosity of natural history enthusiasts or veterinarians or pet owners. It is indicative that the first word of the book is "Because" and the last word is "mankind." The book will be a rich quarry for game management scientists and research biologists and should help some conservationists to lay away once and for all the old-fashioned idea that wild animals cannot be kept and bred in captivity. True, the story that unfolds through the almost eight hundred pages is a tale of much early failure in one way or another, but it is also a remarkable chronicle of developing suc-

cess. As the captivity history of one wild species after another is told, early failures in simple maintenance are gradually followed by increasing longevities and eventually by successful and finally repetitive breeding. The picture emerges of an applied science gradually maturing; one to which more and more species yield their secrets. A profession which could not keep gorillas alive a few decades ago now begins to breed them — and to breed the great Indian Rhinoceros and the Koala. Menageries have become zoological parks and while their ills and abuses are still with us, the Crandall book in its careful review of facts shows reason for optimism about the role zoos may play in preserving endangered species. It records the history of three spectacular wild mammals, extinct in the wild, which have already become zoo wards; Prjevalsky's Horse, the Père David Deer and the European Wisent. One cannot help but wonder whether the extinct Quagga or the Dodo might not have been saved by the zoo know-how of today. Could these animals have been preserved in zoos and eventually reintroduced in parks maintained by an enlightened people?

But the myriad failures in zoo maintenance and propagation efforts, as shown by Mr. Crandall, should have the salutary effect of pointing out where, and in some cases how, zoo people should direct their efforts. In this connection one thinks particularly of the notable zoo failures with those endangered and beautiful Malagasy primates, the Indris and Sifakas. More importantly, the book may save countless zoo animals from death at the hands of zoo and laboratory men who, with no opportunity to learn better, blindly repeat the unrecorded errors of their predecessors.

The great care that has so obviously been lavished on this book cannot help but tend to raise the standards of zoo animal-keeping. And I believe it will stimulate a flood of publication as new facts come to light, supplementing the basics Mr. Crandall has set down. Failure to find time to publish is the characteristic of professional zoo men, and some of their reluctance has surely rested on the great effort required to find out whether their information is really new. Mr. Crandall has built a firm foundation on which we can go on building.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM
AND THE DEPARTMENT OF TROPICAL RESEARCH

Grant to Society Assures Construction of Laboratories of Marine Sciences

A GRANT OF \$350,000 has been made by the National Science Foundation to the Zoological Society toward construction of the Laboratories of Marine Sciences at the New York Aquarium. We expect to start construction this fall and complete the building in the fall of next year.

Other grants and gifts had already been made to the Laboratories — \$250,000 from the Health Research Council of the City of New York, \$10,000 from the New York Foundation and \$50,000 from Mrs. Alan M. Scaife and her family of Pittsburgh, members of the Zoological Society.

In announcing the grants, Dr. Fairfield Osborn noted that the new center will be the first of its kind in any of the world's large cities. "The work that will be done here holds great promise for utilization of the sea's resources," he said. "In recent years there has been a growing realization of what the sea holds for the benefit of mankind. A new pharmacology of 'drugs from the sea' is being developed from marine organisms. These new Laboratories will greatly expand the marine research the Society is now doing with its present facilities in genetics, marine pathology and marine bio-chemistry. It will provide quarters for studies in the physiology of marine mammals, fishes and invertebrates, as well as special rooms for the study of electrical impulses in fishes and the problem of marine pollution with its consequences for human health.

"This financial support is further recognition of the prolonged scientific work at the Aquarium concerning fish diseases, the pharmacology of growth-inhibiting and growth-stimulating substances from marine organisms, the bio-chemistry of marine invertebrates, the genetics and endocrinology of fishes and other related research. It

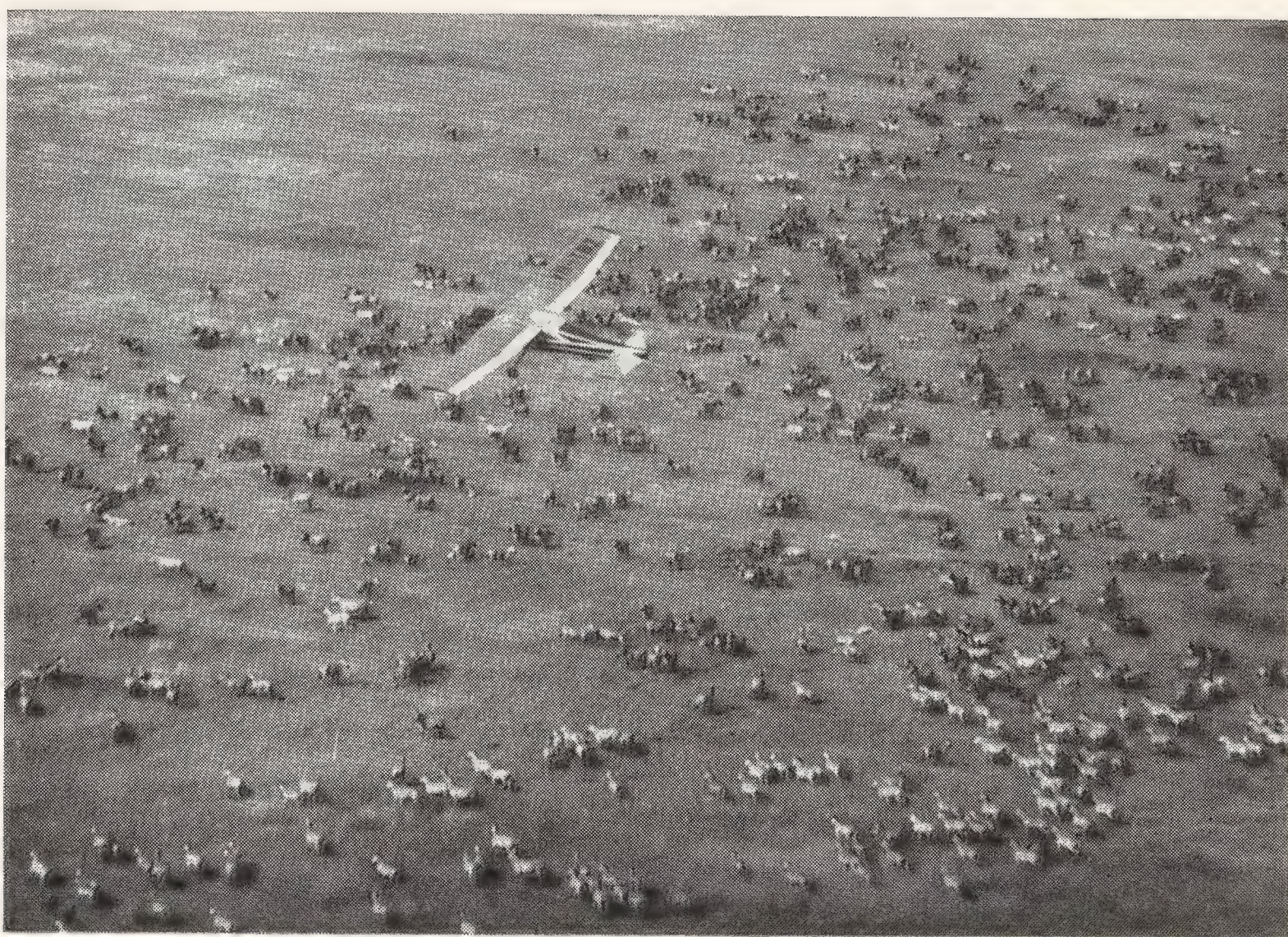
also reflects the advantages New York City offers as a site for a marine science institution that can draw upon the technical personnel and facilities of many other nearby institutions — universities, medical centers, research institutes, museums and libraries. Only through collaboration with such organizations through many years has it been possible to build up the existing program of research in this field."

The new Laboratories will be under the directorship of Dr. Ross F. Nigrelli, present head of the Zoological Society's Department of Marine Biochemistry and Ecology. It will have an initial staff of eleven scientists working on specific problems under grants. The Society has already received a research grant of \$266,400 from The John A. Hartford Foundation, Inc., and other grants from the Office of Naval Research, the National Cancer Institute, the Damon Runyon Memorial Fund and the National Science Foundation.

The new Laboratories building was designed by the architectural firm of Goldstone & Dearborn. It will be located adjacent to the present New York Aquarium in Seaside Park, Coney Island, and has been so designed that additional wings can be added at any future time.

American Bison Society Material Deposited in Denver Library

Ever since the American Bison Society was formed at a meeting in the Lion House of the Zoological Park in 1905, the original minute books and several file cabinets of correspondence dating from the early days have been kept in the Zoological Society's archives. Now they have all been deposited in the Conservation Library Center in the Denver Public Library. Miss Katherine



A Super Cub flies over a concentration of zebras on Africa's Serengeti Plains. The plane was provided by the Zoological Society to help Tanganyika National Parks in patrol work and studies of the game herds.

Seymour has also given to the Center the papers and records of her father, the late Edmund Seymour, who was associated with Dr. William T. Hornaday and others in forming the Society which helped save the bison from extinction.

Staff Appointments to Other Organizations

Several members of the Society's staff, at the Zoo and the Aquarium, have recently been appointed to positions in national and international groups.

Director Conway has become a member of the Board of the International Zoo Yearbook, published by the Zoological Society of London.

Dr. Nigrelli has been elected a member of the International Academy of Pathology.

Mr. Dunton has been appointed a member of a committee to set up qualification standards for the Biological Photographers' Association.

Mr. McKew has been elected to the executive committee of the New York Personnel Managers.

IN BRIEF

Zoo on Television. Miss Michele Perrault of our Education Department has made many appearances on the "Once Upon a Day" television show on Channel 13 this summer. Some of her programs may be seen at 5:30 p.m., Channel 13, on August 3, 19 and 26, and September 11 and 23.

Aid for the Red Colobus. The Red Colobus Monkey is found only on the island of Zanzibar and its continued existence is seriously threatened — so much so that efforts for its preservation are being undertaken by the Tigon Primate Research Center of Kenya. The Zoological Society has contributed \$2,500 to the effort. A similar sum has been granted to the Instituto Mexicano de Recursos Naturales Renovables for the translation into Spanish of Dr. Starker Leopold's book, "Wildlife in Mexico."

Reptile Studies. Curator Dowling and Dr. Victor H. Hutchison of the University of Rhode Island have received a grant of \$45,000, over a three-year period, from the National Institutes of Health for research on "Metabolism and Temperature Regulation in Reptiles." Temperature-controlled rooms for the conduct of the research are to be built in the mezzanine laboratory area of the Reptile House.

Reptile Roundabout. The usual way of getting African reptiles for the Zoological Park's collection is to buy them from dealers or individuals in Africa. Recently we are getting some interesting specimens from Sweden — two Giant Chameleons, two Gaboon Vipers and three Puff Adders. It seems that the pilot of a European airline is an amateur herpetologist. He carries European lizards to Africa, trades them for vipers, and then trades the vipers in America for boas — which he delivers to Swedish zoos.

Big Egg Crop. By mid-July more than 1,200 eggs had been picked up in the Zoological Park and entered in the year's Egg Log. Only a small proportion of the eggs are incubated, of course, but we have already hatched two Inca Terns, Wood Ducks, Mandarins, Chestnut-breasted Teal, Chilean Widgeon, European Shelducks, Graylag and Bar-headed Geese — to name only a few.

Educational Loan Fund. The Society has established a fund from which loans may be made to employees who are taking courses in zoology at accredited colleges or universities, either leading to a degree or, in the case of non-matriculating courses, which would increase their proficiency in their present position.

CORRECTION

Through a misunderstanding, it was reported in the March-April issue of *Animal Kingdom* that Dr. Victor Van Straelen, Director of the Royal Institute of Natural Sciences of Belgium, had died in the Galapagos Islands. Dr. Van Straelen died on February 29 at his home in Brussels, after his return from the Galapagos.

PUBLICATIONS OF INTEREST

FAMILIAR FRESHWATER FISHES OF AMERICA. By Howard T. Walden, 2nd. Many illustrations in color and black-and-white by Carl Burger. 324 pp. Harper & Row, New York, 1964. \$6.95.

This is a delightful book to browse through, stopping to savor a paragraph that begins "On a still morning of heavy frost, when little eddies of vapor are over the lake surface . . ." and to read more extensively about the life and habits and catching (and eating) of familiar fishes. Not the least of the pleasures comes from Carl Burger's drawings, for Mr. Burger is not only a great illustrator — he has been a fisherman since his Tennessee boyhood. And somehow affection for a subject generally shines through, in writing or illustrating.

THE WORLD OF THE RED-TAILED HAWK. By G. Ronald Austing. 128 pp., many photographs, maps. Lippincott Co., Philadelphia, 1964. \$4.95.

Around the year with one of our most spectacular birds of prey. Mr. Austing, a Ranger in the Hamilton, Ohio, park system, writes with informed enthusiasm about all phases of the Red-tail's life, and his 88 photographs are exceptionally good.

COLLEGIATE DICTIONARY OF ZOOLOGY. By Robert W. Pennak. vi + 583 pp. Ronald Press Co., New York, 1964. \$8.50.

Concise definitions of some 19,000 zoological terms, plus a useful 17-page condensed taxonomic outline of the animal kingdom. The author (Professor of Biology, U. of Colorado) notes that "vocabulary frustration" hampers students; this dictionary will go a long way toward easing the path of anyone whose reading has to range over a wide zoological field. Besides general terms, it defines a large number of Orders, Families and Genera and identifies important zoologists.

THE LAND AND PEOPLE OF NEW ZEALAND. By Edna Mason Kaula. Maps and photographs, 160 pp. Lippincott Co., Philadelphia, 1964. \$3.25.

A popular account of the history of New Zealand, including a brief and incomplete account of its wildlife.

WILDLIFE IN AMERICA. By Peter Matthiessen. Many black-and-white illustrations by Bob Hines. 304 pp. The Viking Press, New York, 1964. \$1.95.

First published in 1959, "Wildlife in America" was hailed as a strong blow for conservation, since it covered the whole sweep of North American wildlife and man's effect on it. This paperback edition should extend its influence, and it is excellent for quick reference since it gives lists of rare, declining and extinct vertebrate animal species in North America, a chronology of legislation affecting North American wildlife, and a good working bibliography.

A HERD OF RED DEER. A Study in Animal Behavior. By F. Fraser Darling. 226 pp. The Natural History Library: Doubleday & Co. and American Museum of Natural History, 1964. \$1.25.

A paperback edition of a classic study of Red Deer in Scotland, first published in 1935.

BOY'S BOOK OF FISHES. By Edward C. Migdalski. 172 + viii pp. Illustrated. The Ronald Press Company, New York. \$5.00.

This seems to contain the answers to just about all the questions people interested but uninformed would need to know. The answers are necessarily brief, and here and there clarity has apparently been sacrificed to brevity, notably in locomotion. We would recommend this book. — C.W.C.

THE WATERFOWL OF THE WORLD. By Jean Delacour. Vol. 4. With contributions by Hildegard Howard, Milton W. Weller, Philip S. Humphrey and George A. Clarke, Jr. Six plates in color by Peter Scott. 364 pp. Country Life Ltd., London, 1964. 6 guineas (app. \$18).

Volumes 1, 2 and 3 of this impressive series, appearing in 1954, 1955 and 1959, respectively, have already been reviewed in *Animal Kingdom*.^{*} Volume 4 brings to an end the devoted labors of the author, already distinguished for his many contributions to the advance of ornithology, and of Peter Scott, whose superb illustrations have added so much interest and beauty to the production. Rather than encumber the earlier volumes with more technical material, this has been incorporated in Volume 4, with the help of the specialists noted above. The subjects covered in detail include general habits, reproduction, ecology, distribution, conservation, anatomy and fossil records of waterfowl. Finally, Mr. Delacour has allowed himself the luxury of a chapter devoted to "corrections and additions," bringing the earlier volumes up to date. Completion of this magnificent work should give the greatest satisfaction to author, contributors and readers, alike. — L. S. C.

^{*} 58(2):64, 1955; 63(2):64, 1960.

THESE FRAGILE OUTPOSTS. By Barbara Blau Chamberlain. 327 pp., many photographs. The Natural History Press, Garden City, 1964. \$6.95.

Subtitled "A Geological Look at Cape Cod, Marthas Vineyard, and Nantucket," this is obviously not a book for just any summer visitor to "The Cape." On the other hand, it is a serious contribution to one phase of our knowledge of a famous bit of Massachusetts.

EAST AFRICAN WILDLIFE JOURNAL. Vol. I, August, 1963. 131 pp., photographs, charts, maps. East African Wildlife Society, Nairobi. Published in 1964. \$2.50.

A kind of yearbook of the East African Wildlife Society which is doing valuable work in conservation. The *Journal* contains articles on the Arabian Oryx, East African birds of prey, animal husbandry research and wildlife in East Africa, the food of elephants in the Tsavo park, the Black Rhinoceros, the Spotted-necked Otter, and ecological separation of large mammal species in the Tarangire Reserve, besides numerous research notes. Volume II is to be published later this year.

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*We're getting ready
for a fall Garden Party!*

Thursday, September 24, 1964



Members' Day is usually in the spring. This year we postponed it so our Members could have a preview of the extraordinary new Aquatic Birds Building in the Zoological Park. To put it simply, this is the best building of its kind in the world.

Members of the New York Zoological Society will be the first to see it. Public opening will be the day after the Garden Party.

Reserve the date: Thursday, September 24. But an announcement will be sent you well in advance.



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ANIMAL KINGDOM

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THE MAGAZINE OF THE NEW YORK ZOOLOGICAL SOCIETY

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ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

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"Something New Under the Sun"

THE OLD SAYING, "There is nothing new under the sun," is only a partial truth. All manner of things are *new* these days — whether worldwide social and political concepts or material innovations such as radar and even the housewife's boon — the washing machine.

In the special world of zoos and public aquariums, great changes are also taking place. The barred cages and cramped quarters of earlier times are now taboo. They were in many respects unsatisfactory for animals, were lacking in beauty and, above all, failed to convey to the public a comprehension of nature and the wonder of living creatures.

With the abandonment of these old exhibition methods, virtually limitless opportunities have opened up. These will contribute greatly to the contentment and welfare of the animal collections and, at the same time, will add immeasurably to public understanding concerning wild animals, the ways in which they live, their social groups, methods of courtship, feeding and migration, as well as the great variety of environments to which they have become adapted. In the latter regard, the "zoo of the future" will have far greater force as an educational center.

The fact that such ideas actually can be carried out is brilliantly demonstrated in the creation of the new Aquatic Bird Building which was opened to the public on September 25th. It is a tribute to the skill of Director William Conway who is primarily responsible for its layout and design. It also represents a fine team effort in which many of the staff have contributed their special talents. We are indebted also to Harmon Goldstone whose architectural services have resulted in a building that admirably meets its purposes.

This new building is a symbol of our "Zoo of the Future" and presages a number of equally remarkable developments that are now being carried forward at the Zoological Park and, in turn, are being planned for the Aquarium.

Fairfield Osborn

SMITHSONIAN
INSTITUTION

OCT 27 1964

Eighteen hundred Members of the Zoological Society heard Dr. Osborn's brief dedication of the building.

A NEW HOME FOR THE WATER BIRDS OF THE WORLD



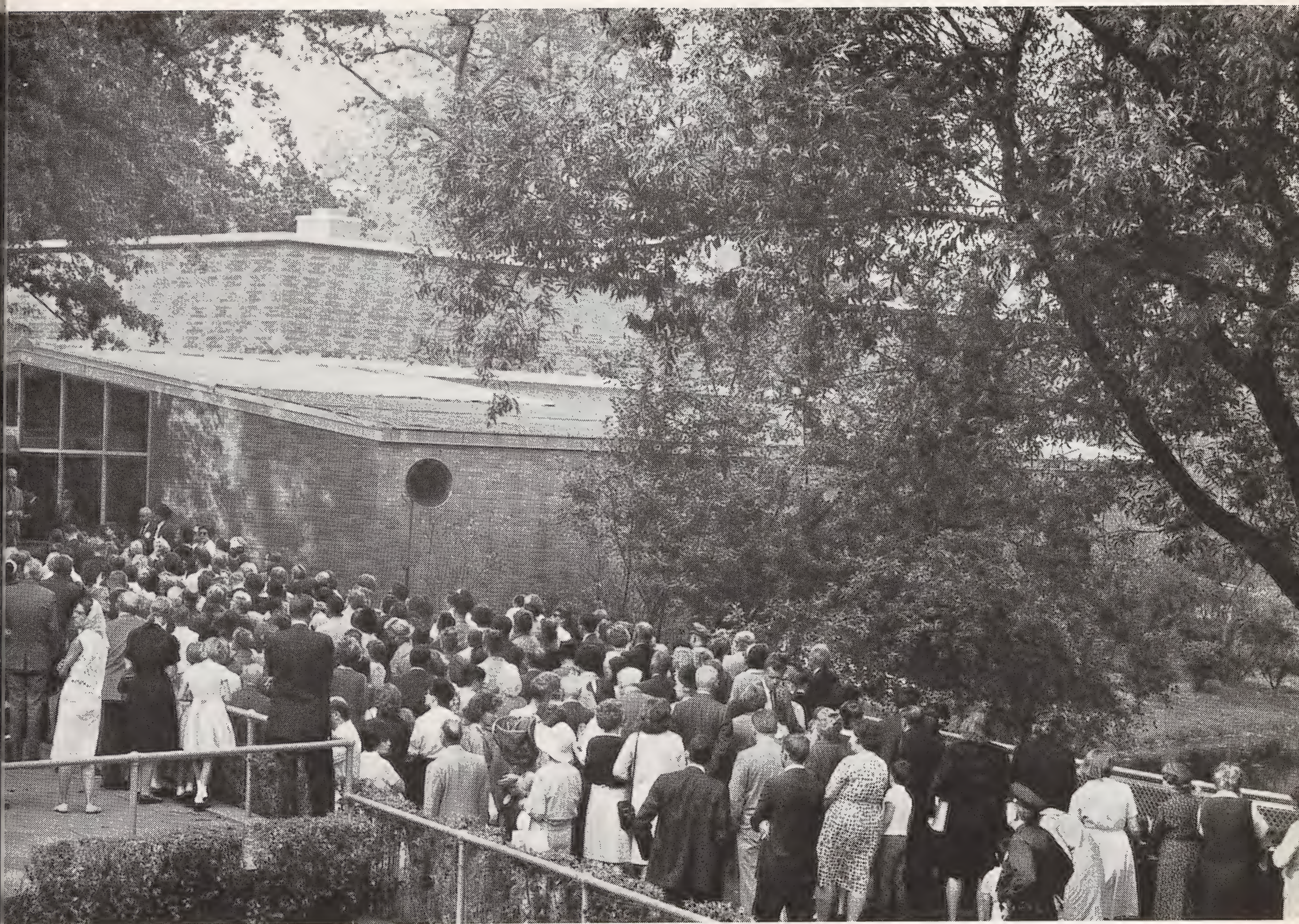
By WILLIAM G. CONWAY

Director & Curator of Birds

ON THURSDAY, September 24, the Zoological Society opened its new Aquatic Birds Building to its Members at the Annual Garden Party. On Friday the building was opened to the public. It exhibits herons and spoonbills, rails and stilts, flamingos and ibises, storks and jacanas, avocets and hammerheads, stints and plovers, terns and cormorants and other birds dependent for their livelihood on wetland homes.

Behind this matter of fact preamble lies an interesting story, and it is one we are rather nostalgic about.

The exhibition of aquatic birds has a special significance to the Society, for the Zoo's first



major building was the old Aquatic Bird House; it was opened on November 8, 1899, in a dedication ceremony for the whole Zoological Park, and today's new building sits squarely on the foundation of the old — literally. Besides, waterbirds have long played a part in Zoological Society efforts on a variety of fronts; major efforts such as those that helped create the Migratory Bird Laws and the Blayne-Blauvelt Act and more minor efforts such as those which resulted in the rearing of the first captive-propagated Whooping Cranes and our successful expedition in quest of the beautiful James's and Andean Flamingoes.

All things considered, it is not surprising that as the old building deteriorated and new zoo techniques developed, the Society turned its thoughts and energies toward providing something very special for waterbirds. Organization and planning began as long ago as 1958, for we

were determined to create an exhibit not only special in execution but different in concept, a living exhibition that would be refreshing and thought-provoking.

We soon saw that the building could not be too large; neither funds nor site would permit. But then it would not have to be too small, either. A rambling geographic arrangement of the collection was out of the question and the zoo's over-all plan of development had allotted adequate space for expositions of animal geography anyway. The basic philosophy was clear; the exhibit should present to the visitor *the type of bird in the kind of place in which it lives*. We wanted a new building that would do *more* than just show what kinds of waterbirds there are; we wanted to show where they live and, because of this "at home" setting, try to show what they do and what they don't do, and to tell why, unmistakably.

The old Aquatic Bird House was, of course, a reflection of its times — the heyday of systematic zoology and ornate architecture. Its two long rows of little square cages were the product of a desire to show, principally, what kinds of water-birds there were. Naturally, the new building is a product of our own times, of an emphasis on information excitingly presented and of concern with the almost universal retreat of nature before man's massive multiplication. A portion of text from one of the new building's special displays catches the feeling:

"Free as a bird" is a misleading expression. Birds are not free; they are prisoners of those special places — their habitats — where particularly modified feet, beaks and other adaptations enable them to find food and reproduce.

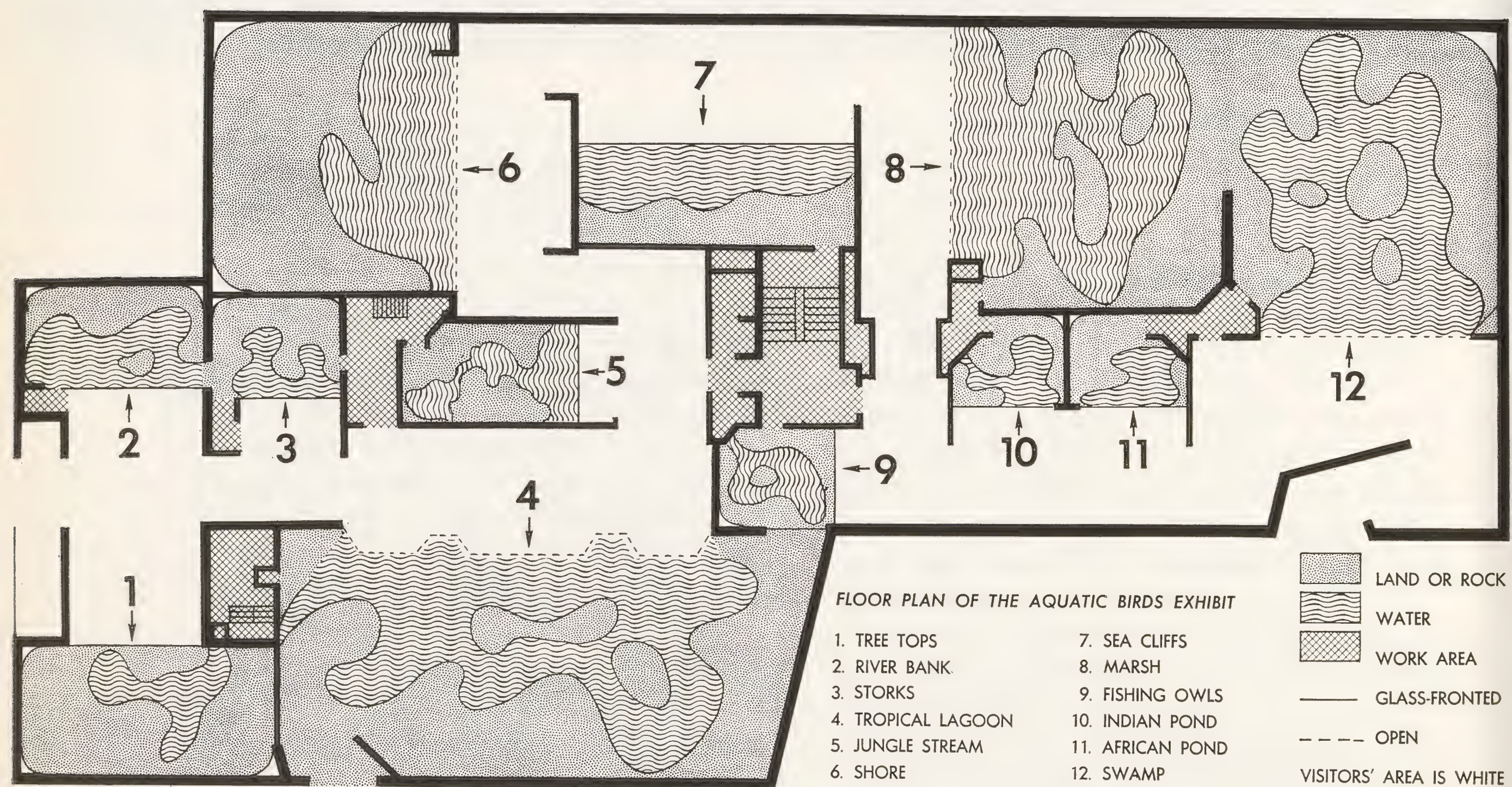
This building provides generalized reproductions of a few aquatic habitats now especially subject to despoliation by man through drainage and disturbance.

If we fail to preserve relatively undisturbed segments of the world's dwindling wetlands, there will be no aquatic birds.

If the need and thus the special problems to be solved in the "New Aquatic Bird House PV

269" (as it was called in the City's records) were immediately clear six years ago when the Society and the City agreed to initiate a joint "Capital Budget Project," the techniques required to develop the displays demanded much more thought.

An outline of exhibits was needed, their specifications and types and, of course, an interested creative architect. The latter requirement was met, and met wonderfully well, by Harmon Goldstone of the architectural firm of Goldstone & Dearborn. Eventually outlines and specifications were completed, engineers were consulted and little by little the basic building emerged on paper. It sounds so simple, now! Of course budget problems were encountered, revisions effected, new ideas incorporated and some cherished ones abandoned. Assistant Curator Joseph Bell, Head-keeper Andrew Winnegar and Aquatic Bird Keepers James Bardsley and Robert Edington checked drawings and helped Architect Goldstone and Superintendent of Operations Driscoll and me catch errors and find solutions to the very peculiar problems of a building for waterbirds. Help and suggestions came from many but the contributions of Alfred Engel from the Bureau of the Budget and John Mulcahy, Paul Dombroski and Max Kaufer of the Department of Parks were





especially important. And all of this took a great deal of time.

Despite much help it is a commentary on the complexity of modern cities that it required almost as much time to solve the sewer design problems of the keepers' washroom in the new building as it did to design and build the whole of the old Aquatic Bird House. Often it was a comfort to recall that budgets were a problem back in 1899, too, for the old building was planned as a \$16,700 structure and actually cost \$24,084. The new building, only about twice the size of the old one, cost approximately \$560,000; The City has paid three-fourths of the contract price and the Society has assumed one-fourth plus all preparation and collection costs.

In planning the building we set up several exhibition principles that we felt were basic to the effectiveness of the displays. Fundamental was the importance of having meaningful major displays rather than many crowded small exhibits that would simply permit a larger collection. Too often zoo exhibits crowd too many wild creatures into unsightly wire prisons or, more recently, tile bathrooms; such collections enhance the zoo's census but tend to defeat its visitors. We wanted our visitors to walk away with something

Boat-billed Herons habitually perch and nest in the treetops. To show them in this habitat niche, the trees in this exhibit were planted several feet below the visitors' floor level.

special — with a feeling, as it were, for heron and habitat. And so we felt that the esthetics of the exhibits must not be allowed to suffer, that the birds should not be closely confined in small cages and that spaciousness within the limits of our budget was mandatory.

Spaciousness could be accented in many small ways. Curved corners give the eye less clue to the limits of available space, so all exhibit corners were curved. Natural light and live plantings emphasize the habitat feeling, so almost every exhibit was provided with a full skylight and an adequate planting floor. We installed full-height mirrors in one display so that the feeling of space is doubled. But other considerations were of equal importance.

In order that the visitor might have as unobstructed a view of the birds as possible, the four largest settings have no barrier between birds and people — except a normal restraint on both sides. Open-fronted bird exhibits are not new, of course; the first one was built in the Bird-



A meandering watercourse in the floor of this exhibit helps to create the "Riverbank" habitat of such showy and striking birds as Cattle Egrets, various gallinules, and Glossy Ibises.

house of the St. Louis Zoo by Zoo Director George Vierheller and Architect John Wallace back in 1930. Mr. Wallace has told me that the development of the display was, in some ways, accidental. A large planted central patio was planned, where a few birds with clipped wings would be allowed to run about and where macaws and other brilliant psittacine birds might be confined on attractive perches. Eventually it was discovered that some of the clipped birds had molted and were flying about in the "patio" but rarely leaving it. Thus the first open-fronted exhibit was born. At the Antwerp Zoo an entire hall of small, brilliantly lit cages with open fronts was developed in 1945 or 1946, on the basis that most small diurnal birds are reluctant to fly into the very dark public corridor. Many aquatic birds are less hesitant about trying their wings in the dark and the light spillage from our brilliantly skylit cages into the public corridor at the new building makes us slow to trust this principle. But there is a secret "barrier" built into the large open-fronted displays and it is really very simple. The displays themselves are much the nicest place available for the bird to spend

its time! After all, a building which includes an open-fronted exhibit always has double swinging doors to bar unplanned exits and, to leave the display, a bird must fraternize with all those people! Our building may present us with a few new problems, however, for we have a number of "open-fronts" and we might have to contend with a certain amount of unwanted bird traffic from exhibit to exhibit. But we have interposed swinging doors and a twisting public corridor, and frankly we are more concerned about the visitors trying to get into the exhibits.

In order to discourage small boys and very close-up bird watchers, we have used a three-fold guard system. First, a railing; second, a "water-moat" (for every open display has a pool that runs across its entire front); and, finally, to dismay the athletic wetback, we have installed a closed-circuit television system. A television screen in the kitchen, where the keepers must spend much of their time, gives a continuous view of the visiting public and by means of a microphone in the kitchen and loudspeakers at the exhibit, keepers can warn would-be human waterbirds. Actually, open-fronted exhibits at the St. Louis, Philadelphia, Colorado Springs and Chicago zoos have posed no serious problems.

In designing any public building, and especially one certain to be popular, a most important consideration is the visitor traffic pattern.

By eliminating certain paths and approaches, we have tried to induce a one-way flow from south to north. Inside the building, except in the entrance vestibule, exhibits are confined to one side of the public corridor, thus eliminating the need to back-track to see everything. Ramps connect the three levels of the public space and thus even a wheelchair visitor may make the tour from one end of the building to the other with ease and comfort. The multilevel effect helps to create new interest at every point and avoids the monotony of the traditional long rows of displays on either side of the public space. Indeed, no two displays have the same floor level in themselves.

The organization of the public space has come in for special consideration. It is disturbing to the effect of a major exhibit when it is crowded by often unrelated displays in a single large hall — other viewers and other exhibits intrude. In our new building we are striving for a series of strongly contrasting habitats and niches and — striking and natural as each one is — they would scarcely be believable without time for digestion in between. Therefore we try to present the major displays one at a time, to take the viewer

Two of the best “showmen” in the new building are these African Wood Ibises. Gravely posing on a keeper-made nest or on elevated branches, they attract many photographers.

around a corner before opening up a new vista for him, and in a way to compartmentalize the public space so as to break the viewers into groups looking at one exhibit entity at one time. We hope this will eliminate some of the distraction of large crowds in front of multiple exhibits, with their inevitable divided attention.

Set in the walls between exhibits and so placed as to draw the visitor's attention are glass-fronted graphic presentations of facets of the waterbird world — a typical reproductive cycle, the meaning of habitat and niche, waterbird conservation, an exposition on migration and bird navigation — all produced by our new Exhibits Department under Jerry Johnson.

The walls themselves make an interesting contribution to the building's effect, for they are of pleasingly colored structural tile and emphasize the break between habitat display and public corridor. Service passages and entrances are unobtrusively placed and all the major service facilities are in the basement.

The “behind-the-scenes” organization of the building is itself anything but conventional. The boiler room and major air handling units are on a mezzanine floor, upstairs rather than in the basement, and thus the latter is relatively machinery-free and given over to the kitchen, winter quarters for tropical birds of prey, quarantine and rearing facilities, and an air conditioned quarantine room for birds of the Arctic or Antarctic.



Here also is a keepers' office and shower, a freezer and a long row of storage bins for various kinds of food. No "Bird House cellar" this; the entire basement is well lighted and brightly colored!

The first display in the building sets the keynote for the whole. A lighted title over a large glass-fronted setting announces "the Tree-tops" — a statement not of the species exhibited here, but of an ecological niche. And we have indeed dropped the exhibit floor considerably below the visitor's level and in effect brought him into the building at heron-height, face to face with a treetop heronry, nests and all.

There are some things you cannot leave to chance and nests are among them. We built the nests — Messrs. Edler, Diven, Cavanagh and Nielson of the Bird Department built them, to be exact. Actually the addition of artificial nests to the various displays, built according to the species specifications of the birds in each, is one of the more important contributions to the techniques employed in the building. It certainly is much better to *show* what a bird's nest looks like than to try to *tell* about it. Moreover, we are interested to see whether the presence of nests will stimulate the birds to breed earlier than they might otherwise. Experiments in the past give us reason to be hopeful.

We hope the treetop exhibit technique will be adopted and adapted widely, for it would allow many arboreal creatures to be displayed in more stimulating and "natural" settings — monkeys

and tree snakes, for example. Our heronry is the home of a group of Boat-billed Herons, a curious species whose natural history and behavior have been little studied. But true to our theme we are including other species whose ranges do not necessarily coincide with that of the Boat-bill, but which share a liking for treetops. The important thing, from the standpoint of the story we are trying to tell, is that all the birds nest in treetops, often in colonies.

Further down the corridor and around a corner beckons a lighted announcement, "a Jungle Stream," and here the visitor looks up at a tropical brook cascading from a high ledge through a verdant rocky course to end up at the glass directly in front of him. The overhanging plants and vines, the jewel-like kingfishers and diminutive rails, are real and so is the water, but the rocks are a wonderful sham. The entire rocky setting was staged in fiberglass and built in place by the Zoo's Exhibits Department with the help of our machine shop. Fiberglass seems to offer almost endless possibilities for zoo displays, for it makes it possible to achieve the effect of delicate natural settings in a strong, wear-resistant material. Thus we now have a more workable solution to the problems posed by active, in a sense destruc-

The first open-fronted area the visitor sees is the Tropical Lagoon, winter home for flamingos and spoonbills. In summertime they have access to a gracefully designed pool outdoors.





tive, live animals in a relatively small space. The Arizona-Senora Desert Museum has used fiberglass in live displays but little has been done in zoos on a really large scale.

Our largest fiberglass exhibit to date is not the "Jungle Stream" however, but a display further along in the building and bearing the title of "the Sea Cliffs." The setting is aquarium-fronted, nearly thirty feet long and about ten feet deep. Along its entire back wall is an immense, brooding, gray cliff face — of fiberglass rock which extends up right out of sight of the viewer. As if the cliff effect were not enough, huge mirrors at either end of the exhibit enhance the impression of size and distance. The cliff, like the tropical stream, was built by the Exhibits Department. This is an unusual and important display in many ways, for it is designed to exhibit alcids such as Puffins, Razor-bills, Murres and Guillemots, a group which presents special

A jungle stream is a safe, secure and bountiful half-world of green light and mossy dampness. This is the world of shy and secretive birds — finfoot, wagtails, kingfishers, rails.

problems and has seldom been shown in zoos. As long ago as 1957 we experimented with Puffins and were successful in working out techniques for their care. We found they did best when kept in air-cooled quarters and that they should be shown in an exhibit which provided underwater viewing. Right now we have the exhibit but no Puffins! The best time for collecting alcids is during the summer months, but we were prevented this season because the building's contractors failed to meet completion schedules. For the time being we are showing an almost-as-interesting group of Guanay Cormorants and Inca Terns from the rocky bird islands off the coast of Peru.

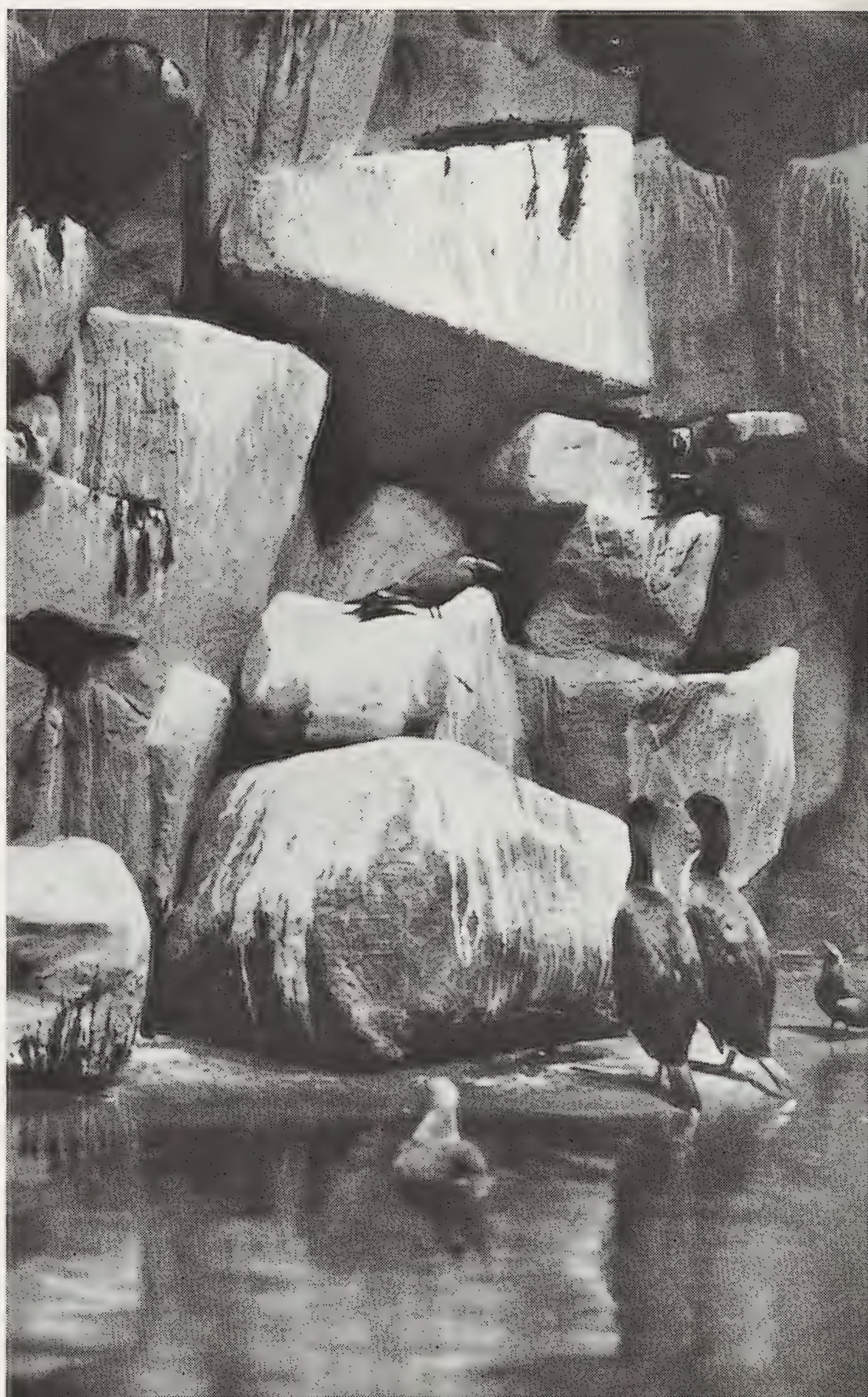


“The Shore” is an open-fronted exhibit — so realistic that some visitors believe they can smell salt air! The birds keep up constant busy activity.

A small segment of “The Sea Cliffs,” whose massive rockwork soars out of sight. Inca Terns and Guanay Cormorants find themselves quite at home.

It is an extraordinary sight to see red-billed white-whiskered Inca Terns diving for fish in front of one's eyes and to watch Cormorants streak underwater at the edge of the cliff, encased in an envelope of silvery bubbles. It is such scenes we are trying to leave in the visitor's memory: not just a recollection of a series of birds in a series of cages but rather the experience of seeing marvelously adapted creatures exercising those adaptations in typical settings.

One of our most successful stagings is of a very different type. Entitled “the Shore” it presents a clean sandy beach strewn with driftwood and seashells, casually interrupted with clumps of beach grass and bayberry. The low crash of





surf you hear is, admittedly, tape-recorded, but the waves that lap the sand are real, even if they *are* generated by a hidden wave machine. They are not big waves, for it is not a big exhibit — just small wavelets lapping on the shore and spilling over the display's raised open-front, to splash, literally, at the visitor's feet. It is a remarkably successful and lovely exhibit. Little Stints run back and forth at the water's edge, Plovers whistle their clear calls and Terns occasionally rise in the air to circle past the faces of the viewers. A map of the New York area nearby shows many of the best "birding" spots and illustrates some of the waterbirds readily seen on nearby beaches and marshes.

The next open-fronted exhibit is "a Marsh," a setting that seems to melt into the edge of a great swamp, for the back of the display is an almost invisible screen separating a swamp ex-

The Marsh is the third of the open-fronted exhibits. An almost invisible screen separates it from the Swamp in the background, thereby enlarging it and creating a misty atmosphere.



hibit. It is a setting that offers many problems, for there are many kinds of marshes and in most of them the birds are usually invisible. We have compromised by offering both heavily planted and open areas. We have also attempted to grow a number of waterplants in our simulated marsh's waters. This is no mean feat and only time will tell whether birds and light and temperature conditions will enable us to be successful.

From their behavior the birds in the exhibit leave little doubt about their "judgment" of its success. The wonderful flock of tall, slender stilts indulged in courtship antics the moment they were introduced. Very much at home, too, were the long-toed Jacanas, skittering over the floating water plants like giant water striders, and herons and plovers hunting the edges of the water as if they didn't really know just where their keeper had placed their rations.

But perhaps the most spectacular setting in the building is "the Swamp." It is the final exhibit and visitors approach it by a planned twist in the corridor so that they come suddenly upon great

The Swamp is the last of the 12 displays, a triumph of realism as sunlight strikes through Spanish moss, egrets stalk among water hyacinths.

Approach to the Swamp scene is past these exhibits — Fishing Owls at the back and waterbirds of India and Africa alongside the sloping passage.





cypress trunks rising from the water and soaring out of sight — giant trees surrounded by “knees,” hung with vines and festooned with Spanish moss. Snowy Egrets glide and skip from point to point like lively ghosts in another world while Sun-bitterns fan their improbably patterned wings with regard only for other Sun-bitterns.

Our huge logs, several nearly four feet in diameter at the base, were provided from a lumber company’s property in Maryland. Assistant Curator of Birds Joseph Bell tramped into the swamps and selected each tree. Riggers and special equipment were hired to set the trees in position and the pool was built after the trees were securely in place. A sliding wall will permit replacement of the logs should that ever become necessary.

Big-tree swamps have always seemed to me to enfold an especially solemn and cathedral-like atmosphere. They are imbued with a special mystery and fascination — tall trees, quiet dark waters, unseen life. Those I have explored — the Okefenokee, the Dismal Swamp, Corkscrew — are the most beautiful wild lands I know and we have tried hard to represent them fairly.

So this, at last, is our Aquatic Birds Building, risen on the foundations of the Zoological Park’s first building of 65 years ago. In today’s idiom it offers understanding and enjoyment — but alas, of creatures and settings representative of wonderful wild places now disappearing rapidly and needlessly. Its greatest responsibility will be discharged if it arouses interest in conserving wetlands and waterbirds.

What Is a Skink?

A COSMOPOLITAN REPTILE

By HERNDON G. DOWLING

Curator of Reptiles

APPARENTLY my predecessor as reptile curator, Raymond L. Ditmars, was often asked, "What is the name of that lizard that sounds sort of like 'skunk'?" So far I have not been asked that particular question. Perhaps this is because people are better informed these days.

In any case, an adequate answer to what a skink is would cover a great deal of territory. The family Scincidae (whence the common name — or vice-versa, I'm not sure which came first) is *cosmopolitan* in the best reptilian sense of the word. No one knows how many kinds of lizards are included by this family — perhaps 500 species, maybe more. Most of these are small, glossy-scaled kinds. Some are not so small and a few are not so glossy-scaled but all of them have a "skinky" look — a look that is bestowed upon them by their relatively short legs and "depressed" (vertically flattened) bodies. The family is defined, more or less, by its members having rather circular scales, each of which has an underlying bone. This provides an all-encompassing armor that may be one of the reasons for their apparent success in the world.

It was a pair of unrelated but interesting recent happenings at the Reptile House that brought the thought of skinks to the foreground. First a trio of Five-lined Skinks, the first that we have had in some time, were donated to the Park by George Foley, of the American Museum of Natural History. Following this, one of our Blue-tongued Skinks had a baby. This unexpected and much appreciated event was sufficient to set us all to think "skink."

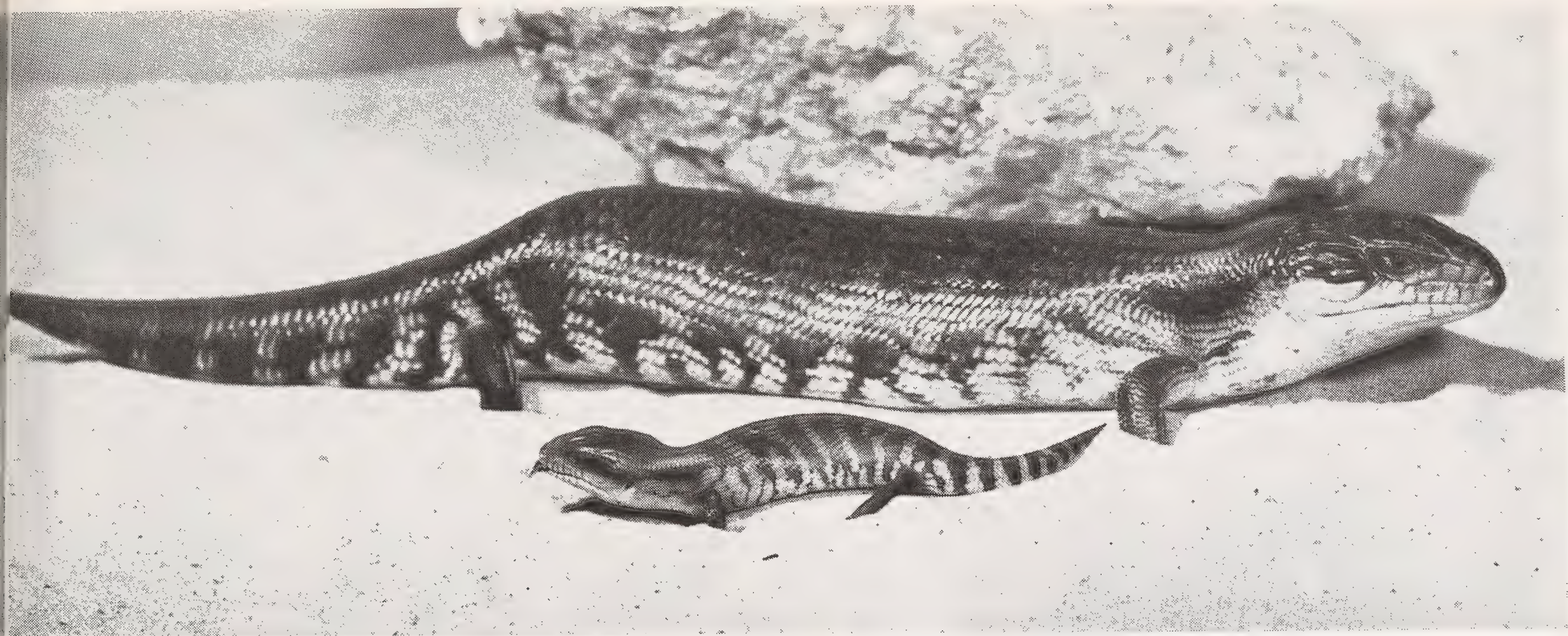
These two kinds of skink are about as different in general appearance and habit as any two lizards could be and they come from opposite sides of the world.

The Five-lined Skink is a local form. It is one of the three species of lizard that are native to New York (one of the others is a skink too, the Coal Skink). It is a small lizard. Adults are only six or seven inches long and half of this is tail. It is primarily an insect-eater, although larger individuals are apparently not adverse to eating small lizards too.

Female Five-lined Skinks ordinarily lay a clutch of six or eight eggs in a rotting log or under a stone. Unlike most lizards, they stay with them and defend them from other small predators until they hatch. The female sometimes leaves the eggs for a short period, when the sun is high, to bask in the sunlight. Whether this is only for her own benefit, or whether it is a method of transferring some of the sun's warmth to the developing eggs, is still unknown.

The Blue-tongued Skink (it really has a bright blue tongue that it often laps out to sense its surroundings) is a native of Australia. It is a stocky-bodied and slow-moving species that often attains a length of sixteen inches or more. It weighs more than ten times as much as the Five-lined Skink. It, unlike most lizards which have fairly specific food requirements, is an omnivore. Ours seems to enjoy everything from lettuce leaves and grapes to chopped meat or canned dog-food. Unlike our Five-lined species, but like the majority of skinks, it bears living young that can forage for themselves immediately.

The Blue-tongue is a representative of a whole group of large-bodied skinks that inhabit the Australian region. Most of these, like the Blue-tongue, are terrestrial, but one from the Solomon Islands is arboreal. It has evolved a prehensile tail — not the highly specialized tail of the African chameleons, but something reminiscent of the opossum's tail — just something to



keep it from falling if it loses its footing. I was first introduced to this unique member of the skink family by Charles Wharton. We were on Guadalcanal at a time when most people were thinking about things considerably different from skinks.

The prehensile-tailed giant was not often seen in the Guadalcanal jungles but certainly its smaller cousins were the most visible, if not actually the most common, of all the reptilian inhabitants of those South Pacific islands. I knew that there must be several species among the many small lizards that swarmed over every sun-splashed log but not only did they look like one another but they looked almost identical to the common skinks of the southern United States.

This is, apparently, typical of skinks. It takes an expert (or a super-expert) to identify a species if he does not know where it came from. As a matter of fact, the skinks of North America (including the Five-lined Skink) belong to the same genus (*Eumeces*) as skinks in Asia and Africa. And the little lizards I watched in the Solomons belong to the same genus (*Lygosoma*) as the little Brown-back of Alabama.

Whether this similarity of nomenclature is completely due to the fact that these small lizards find it easy to hop across oceanic water barriers and are actually very closely related to one another — or whether all these small lizards just look so much alike that no one has taken the trouble to try to split them up into closely related groups — I still do not know.

As I have indicated, skinks are found in the

This baby Blue-tongued Skink was 5 1/2 inches long when it was born on July 23 and it weighed 14.2 grams. Six weeks later it weighed 28 grams. Three babies were stillborn on July 24.

temperate forests of New York and in the tropical jungles of the South Pacific islands. Most, however, are inhabitants of desert, or at least very arid areas. Most of the dozen or so species found in the United States inhabit the plains and dry mountain areas of the West.

An unusual member of the family lives in the sandy areas of Florida. This Florida Sand Skink shows a feature that also seems to be characteristic of the family. When a skink takes up its abode in an area of shifting sand, it does not modify and expand its toes to make sand-walking easier, as so many lizards do. Instead, it seems to take the attitude that with such short legs anyway, it is just not worthwhile.

Instead of sand-waders and sand-runners, the skinks become sand-burrowers and sand-swimmers. Folding the legs close to the body, the skink squirms beneath the surface to avoid predators and death-dealing sun. With such habits, the legs become even less valuable. Ultimately, through selection for efficient body form, they become much smaller, as in the Florida Sand Skink. In some African species the legs are reduced to stubs and in some Australian species they are completely gone.

So what is a skink? It is a strange lizard that comes in five hundred shapes and sizes. But all of them, somehow, look like skinks!

ZOO NEWS IN PICTURES

Photographs by SAM DUNTON

Staff Photographer



*A bird's-eye view of
development of this
at the right of the*

Climax of the morning and afternoon feedings at the Sea Lion Pool is the attempt of a big Steller's Sea Lion to clean out Keeper Martini's bucket of butterfish. What he doesn't know is that no matter how many fish he "steals" he is still getting only his normal 20 pounds each day.



ANIMAL KINGDOM



and in the African Plains exhibit. The next stage of
take in the broad field and slope beyond the trees
ph; all enclosures will be moated and barless.



This would seem to be too many Palestine
Spiny Mice for one small exhibit, but the mice
don't think so; in fact, if we reduce the colony
to "reasonable" size they seldom reproduce.



A diminutive Kit Fox is not a zoologi-
cal rarity — it is common enough on
the western deserts — but visitors are
always entranced by its daintiness.

The African Pigmy Goose belongs to
a group that includes the smallest
waterfowl in the world; this one is
scarcely larger than a pigeon. Ours
may be seen in the Main Bird House.



THE SEA OTTERS OF POINT LOBOS. II

In the previous issue of Animal Kingdom, Curator of Mammals Davis told of a visit he and an artist friend, John Schoenherr, made to Point Lobos, some 80 miles south of San Francisco. This conclusion of their account tells of the Sea Otters they had gone to Point Lobos to observe.—Ed.

WE ARRIVED at Point Lobos Reserve State Park late in the afternoon of the last day of June and saw our first Sea Otter that evening, toward dusk. The Park Naturalist, Judson Vandevere, had offered to show us where the otters were likely to be, and I, at least, followed him with a familiar feeling of pessimism born of having followed other people who were going to show me some prized species or other. Jud had made no promises, though, and perhaps that was why an otter was there. Despite the failing light I stood awed by the sight of a large otter, far below us in the cove to our left. It floated on its back, holding on its chest a large abalone, from which it dined in a leisurely and almost dainty manner, finally discarding the shell.

It is this side of the Sea Otter's personality that has caused it some trouble in the area, for the abalone fishermen are jealous and possessive

where the big shellfish is concerned. In truth, the otters eat relatively few abalone, but when they do they leave telltale evidence behind in the form of a characteristic missing piece from each shell that lies on the ocean floor. Mussels and sea urchins form the bulk of the otters' diet and, to the zoologist, the more interesting part.

We were able to spend only two more days and part of a third watching Sea Otters but, short as the time was, it was enough to reveal a good deal about the life of the animals, particularly for a comparison of their behavior with that of the river otters. Among other things, it brought into doubt a remark made by Ernest Thompson Seton about Sea Otters and Steller's Sea Lions. Like all writers, myself included, Seton, despite his broad personal familiarity with so many of the North American mammals, was often forced to rely on the reports of others, and when he accepted a story of the predation of the Sea Lion on otters he had, I suspect, been sold a bill of goods. Seton listed Steller's Sea Lion as a major predator upon the Sea Otter, but in less than three days we saw numerous instances of Stellers swimming within a few feet of otters. Mother otters with cubs paid no more than the most casual attention to the big seals, and single otters eating mussels



By **JOSEPH A. DAVIS, JR.** *Curator of Mammals*

Illustrations by **JOHN SCHOENHERR**

and urchins continued to munch placidly as the sea lions' heads cut the water near by. These observations do not by any means disprove Seton's allegation, but if sea lions preyed upon otters to any extent at all one would expect the otters to display just a bit less nonchalance in the face of an enemy. (Professor Barabash-Nikiforov writes of the creatures in Russian waters: "When swimming sea otters and sea lions meet, each quietly ignores the other.")

Sea Otters are in many ways the most aberrant of otters. They are the largest members, in terms of mass, of the weasel family. The Giant Otter of South America attains a greater length (nearly seven feet from the nose to the tip of the tail) but based upon the weight of a female at the Bronx Zoo, the males, which are larger, probably do not exceed about seventy pounds—I am unable to find published weights for the species. Sea Otters grow to about five feet or so, but have short tails for otters, and are known to reach nearly eighty pounds. Their hind feet are relatively enormous and, unlike all other species, have toes that grow longer from the inner side of the foot to the outer edge. This characteristic, with webs that extend to the ends of the toes, gives the hind foot the appearance of a seal's rear flipper. By contrast, the Sea Otter's forepaw looks like little more than

a stump. Seen from above the toes seem to have been amputated, and only on the underside can indentations be found that correspond (nearly) to toe separations. One of these is actually two toes, bearing on its upper surface two inconspicuous claws, rather than one. There is, however, no webbing between the toes, nor in fact any functional separation. Yet the otter uses this clumsy-looking club-footed hand with dexterity and does things with it that no other otter species does. It uses these functionally unfingered paws as hands to hold its food, and more remarkably, to break open molluscs by hammering them on stones brought to the surface for the purpose. But it is another characteristic that caused trouble for the species. The Sea Otter has fur so prized that it nearly caused the otter's extinction at the hands of man. In 1910 a single pelt, the last one taken by legal means prior to an international ban on hunting, brought almost two thousand dollars.

Sea Otters once occupied much of the coastal waters of the North Pacific, from the Japanese islands northward to the Kamchatka Peninsula, across the Aleutian Islands to the eastward and down the North American coast to the region of Vancouver Island. A southern race ranged from what is now San Francisco to Baja California. But that was a long time ago. In 1737 Padre Taraval discovered the first Sea Otters at Cedros Island off the coast of Baja California, but did not publish his discovery for twenty years. In 1741 Vitus Bering found, and spent time on, the

island that bears his name. On the beach and in the kelp beds offshore he saw "droves" of otters, and in short order he and his men killed "upward of 800 of them and if the narrow limits of the craft we constructed had permitted, we should have killed three times as many."

One hundred and sixty-nine years later the Sea Otter existed only in a few tattered bands, in the northern waters. Only small numbers of the California herd were seen after the first decade of this century, and a group of 31 otters noted in 1916 was the largest aggregation recorded for some time. Thereafter few otters were seen for more than thirty years.

Protective measures came early for some of the otters. According to Seton's figures, Russia was the first country to awaken to the danger and she regulated the slaughter at about the time of the American Revolution, in the Commander Islands at least. But elsewhere the killing of these trusting animals went on unchecked, so that early in the 19th century Baron Ferdinand von Wrangle of the Russian American Fur Company warned of the impending extinction of the species. A proposal was made in this country in 1874 to regulate Sea Otter hunting, again because of the imminence of the species' doom. The year 1911 finally saw passage of an international treaty, and with painful slowness the Sea Otter has been increasing since that time.

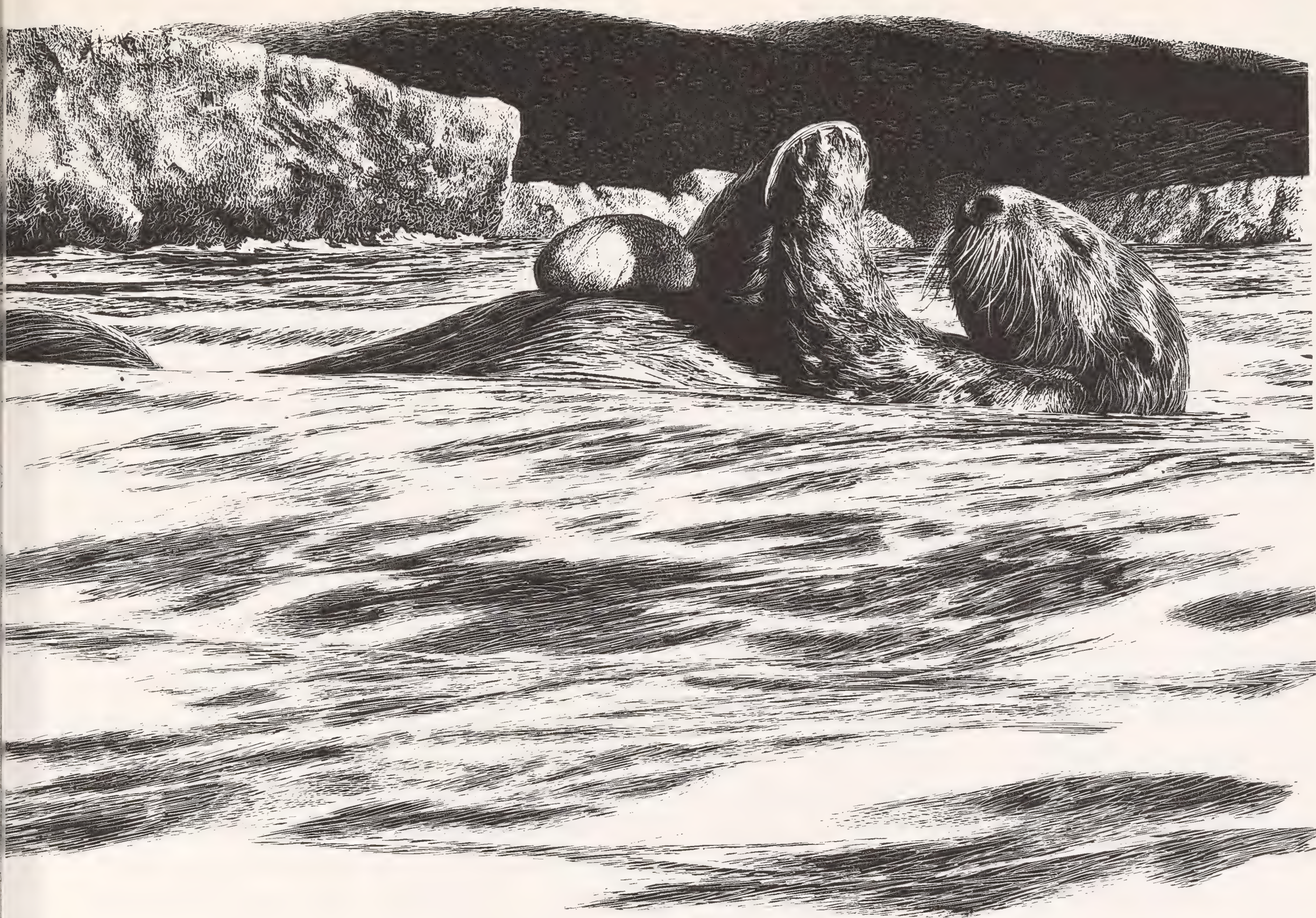
On March 19, 1938, the California herd made its official reappearance as a herd; a group estimated (perhaps overestimated) at 400 individuals was sighted a few miles south of Carmel, on the Monterey Peninsula. Thereafter careful counts showed the herd to number something under a hundred otters — still the largest aggregation known for a generation, at least. Rigid conservation measures have protected these animals, but the otters' low reproductive rate has made their comeback a slow one. A recent survey places their population off California at about 650.

Jack and I confined our observations to Sea Lion Point itself and two adjacent coves, so we never saw the entire population of the area. The herd we spent most of our time with numbered about twenty. An accurate count was difficult for us, as beginners, for two reasons. First, the gas-filled bladders of the kelp, which float on the

surface, look very much like otter heads at a distance — they brought back memories of my turtle-hunting youth when the heads of my quarry and waterlily buds were a problem to distinguish at times. Still, with only a few hours of observation we began to improve in our ability to spot the real otters. The other problem, also a function of distance, was that during the park's visiting hours the otters, resting at the far edge of the kelp beds, were indistinct even with a 60X scope, and we may have missed a few cubs riding on their mothers' chests. Only after the Reserve closed its gates did otters approach the shore, other than an occasional visitor that might come into a cove, but still well away from the shore.

The distant kelp beds were bands of gently heaving glass, subduing the incoming waves within their confines, only to relinquish their effect as the waves passed them on the way to the shore. Within the tranquility of the kelp bed the otters spent their time in seeming languor under the maritime sun — "loitering" was the word that came to mind. Some were apparently asleep or resting, while others groomed themselves in a leisurely fashion, and females cared for their cubs.

In the short time we spent at Point Lobos we were able to recognize several individual otters. Early on our first morning a large otter with the straw-colored head of an adult moved into Whalers' Cove. As she dozed in the kelp (the determination of sex was tentative, but based on the ease with which river otters may be sexed at a distance when on their backs), she turned her head toward us, revealing a bright pink nose that must have been old scar tissue in view of its asymmetrical shape. For about ten minutes she floated on her back, assuming many poses that we think of as alien to non-humans. She crossed her flipper-like hind feet over her abdomen, rested one forepaw on her nose and closed her eyes. From time to time she opened her eyes to look about, or to groom the fur on her arm, but mostly she just dozed. Meanwhile a second otter, a male, perhaps a nearly full-sized cub, appeared and approached Pinky (she had acquired a name by now). The male began by poking about Pinky's head and shoulders. She took the intrusion calmly, and for a while both animals floated together, each occasionally rolling through a full turn. During



one early roll we noticed a small, pink scar on the edge of the left hind foot of the male — in a long-term study these individual distinguishing characteristics would be useful. For half an hour the two otters stayed near one another, each diving below the surface momentarily, to reappear with a morsel of food (probably sea urchins, although we could not tell) and eat it. At one point Pinky reached forward with one hind foot to scratch at her neck; then she put her left forepaw behind her neck in an appealingly human manner, and floated there with her elbow jutting outward and upward. She tucked her chin down into her chest and closed her eyes. The male crossed his wrists on his chest and like the female dozed off.

For the next two days I watched and photographed the otters, and I found myself regretting desperately that we had no tape recorder. It is almost impossible to write notes and at the same time keep a telescope trained on an otter. Even though the animals moved about comparatively little, the rise and fall of the swells made it necessary to keep both hands occupied in maneuvering the scope. I missed a good deal of what was happening because of this, but even so gained a

A water-rounded stone resting on its chest, a Sea Otter holds a mussel and prepares to crack it open by striking it sharply on the stone. An otter can roll over without losing the stone.

far broader picture of Sea Otter behavior than I had expected. The more I have read about the species since that day, the more I have found that most, if not all, of our observations have been made and published by others before us, but the exultation of discovery I felt as each of the facets of the otters' behavior revealed itself has a value that transcends all other considerations.

Most of our observations during the day were of otters lolling at some distance out, but from about five o'clock through the three hours until sunset a number of otters approached the shoreline, in a few cases to within five feet of our rock promontory in the rolling surf. Through much of the first afternoon we crouched in the weirdly sculptured hollows of the rock, only our eyes, the cameras or the telescope showing. The sharp knife-edges of the rock made our vigil most uncomfortable, but it is a measure of the fascination of otter-watching that truthfully we were

aware of our discomfort only when the otters were quiescent. Later things got easier. Just how it happened neither of us remembers, but we found ourselves standing in full view of an otter we had not noticed before. The animal was only a few yards from shore, and although it was aware of our presence it accorded us a total indifference. From then on our work was not limited by topography, and we were able to move freely to the best vantage points whenever our subject moved.

With our new mobility we were able to see other things, too. Although we saw otters eating sea urchins and an occasional abalone, by far the commonest item of their diet was mussels. Twice Jack saw an otter getting mussels from the base of a partly exposed rock in the cove. The tide was coming in by that time and the small portion of the rock still above water was awash with each new wave. As the trough passed, exposing the rock below waterline, Jack saw an otter at the mussel bed grasping a mussel in both forepaws (we had wondered whether paws or teeth were used to dislodge the molluscs), but the mussel clung tenaciously to its rock. As the crest of the next wave swept by the otter held fast to its prey as its hind feet and tail swayed with the water's movement. Several successive waves moved by, sweeping the otter's hindmost parts like a strand of kelp, each trough revealing that it still grasped its mussel. Then the otter surfaced with its booty.

The otters' method of opening mussels is the sort of thing that has been well documented in print, but it must be witnessed to be fully appreciated. Until I saw the procedure myself I confess I only half-believed the stories. Diving to the bottom, an otter would return to the surface with a water-rounded stone. Some of the stones

we saw were a bit smaller than hen's eggs and roughly the same shape, while others were larger and ranged from more or less spherical to rather flattened. Resting the stone on its chest, the otter would hold the mussel between its forepaws, one end in each paw, and strike it smartly a number of times against the stone until the shell cracked. After eating some of the meat the otter would often hammer what was left of the shell on the stone again before resuming its meal. The sound of the hammering was clearly audible. One male frequently crammed his mussel back into the corner of his jaws, presumably using his powerful jaw musculature to further fragment the shell. Otters often roll over in the water — my guess is that this may involve some sort of watch for predators, for their only natural enemies are sub-surface ones — while they are engaged in a variety of activities. Otters with stones rolled over too, but never lost a stone. While hammering mussels on their stones the otters sometimes held their heads pointing upward, and sometimes stretched their heads forward, chin up. Most of the cubs we saw were nearly full-grown, but were treated with tolerance by their mothers. We saw one cub dive and return with a mussel, but most often the cub simply pestered its parent, poking about the mother's head and chest until it could grasp a morsel. I never saw a mother give food to its young voluntarily, but Jack saw a female tear off bits of mussel in her teeth and turn her head toward her cub, which then took the piece.

We saw only one small cub, which its mother clasped tightly to her chest; most of the cubs were already large, but even these clambered up on their mothers' chests. Reliable eye-witness accounts fit together, however, to provide a most engaging picture of maternal behavior. After a



A Sea Otter mother is devoted to her single cub, which spends most of its early life in close association with her.

long gestation, presumed to last eight or nine months, the female produces a single cub which, like a guinea pig infant, is well developed, fully furred and possessed of almost a full set of milk teeth. Its light cinnamon pelage is thick and long, and extremely buoyant; a small cub I once saw in some motion picture footage seemed to float almost on top of the water. The cub may be born either on shore or in the water. The youngster spends much of its early life on the mother's chest, being licked and fondled. The Russian zoologist Barabash-Nikiforov describes a particularly touching scene of a female holding her cub on her chest, sometimes hugging it, sometimes lifting it into the air, turning it over from one side to the other, and licking it; he likened the mother's behavior to that of a human being's. In time of danger the female dives, clasp ing her cub to herself, but when diving for food she leaves it bobbing safely on the surface. The cub stays with its mother for a long period, even, as noted before, when it is nearly as large as its dam, and cubs have been seen with their mothers even after the birth of another baby.

We saw cubs and mothers drift slowly apart as they fed but usually when they were separated by about 200 feet the cub would swim rapidly back to its mother. Once we saw a cub, thus separated, lose sight of its mother and heard it utter a loud, high-pitched "Waaah!" Just as darkness was falling one evening, two females, each with a cub, fed and dozed in the cove. A large male entered the cove and spent some time visiting with each pair of otters. The females accepted his obviously friendly interest.

To return for a moment to the subject of sea lions and Sea Otters, we saw numerous instances of both the Steller's and the smaller California Sea Lions swimming within a few yards — once within about six feet — of otters, without seeming to evoke any interest at all.

Perhaps more important than any other feature of our short stay with the Sea Otters was the comparative data it added to my own study of the river otters. On first view the Sea Otter gives one the impression of being a most atypical kind of otter — as it is, in many respects. Still, for all its uniqueness, the Sea Otter's close kinship to the fresh water species is evident when one has seen at first hand the activities of both. In the three

species of river otters that have lived at home with me, I had witnessed, without knowing it, actions that have reached their fullest expression in the Sea Otter. Naturally the river otters spend most of their time "right-side up," but they do on occasion float briefly on their backs, and of course lie on their backs on land quite often. Frequently, while supine either on land or in the water, my river otters would juggle some small object on their chests — a bottle cap, peanut or even a pebble. This is a form of play for the river otter, but such play is almost surely the matrix from which the Sea Otter's use of stones as tools has developed. Again, the river otters' sociability and the Sea Otters' gregariousness differ more in degree than in kind. This is not to say that any of the present-day species of river otter is the ancestor of the Sea Otter. Their common ancestor was, however, without question a land-lubber, a river-frequenting otter whose behavioral traits diverged in the two main branches of the family tree — keeping within the new patterns the unmistakable signs of their common origin.

Early attempts to keep the Sea Otter in captivity ended in failure, but recent studies by American and Russian zoologists have shown that it can be done; one Sea Otter lived in the Seattle Zoo for 6 years. Basically the problems have involved two factors, temperature and diet. Despite the wide latitudinal range of the species, Sea Otters live only where the air and water temperatures are cool and fairly constant. They do not do well if the temperature of the air goes much below 30° or above 60°, or if the water is less than 40°. Secondly, the food intake of the Sea Otter is phenomenal — it must have as much as 35% of its body weight in food daily, and apparently must eat at intervals no greater than 10 hours apart. Failing these two dietary conditions it develops an enteritis and loses condition rapidly. Other conditions must be met, but they are not insurmountable. The Sea Otter is a creature that merits further close study in captivity, and one that can serve in a zoo the double function of providing wonderful entertainment and a matchless lesson in conservation. Perhaps some day we will be able to exhibit it in the New York Zoological Park. Having seen this survivor of the onslaught of human avarice, I look to that day with hope.

*An Exploratory Dive
Led to the Discovery of—*

THE BLACKCAP BASSLET



By CARLETON RAY

Associate Curator of the Aquarium

ON THE EASTERN SIDES of most Bahamian Islands, the white sands of the beach meet the water and continue for some yards under a lagoon of light green. Here, where giant manta rays occasionally come to feed, a few little coral heads and gorgonian-covered rocks form the only cover for fishes. Further seaward, the breakwater is formed of shallow coral or algal reefs and the open sea begins. Still further, there is a gentle dropoff and the water turns a light

This well-named Blackcap Basslet is the first one exhibited in the Aquarium. All blue, with a strong black area dorsally, it is strikingly different from the familiar Fairy Basslet.

blue. Other corals, sponges and gorgonians put in their appearance and they reach their finest development at a depth of 90 to 100 feet.

And here, as if a knife had sliced into the limestone bottom, there is an abrupt change. No longer gently sloping, the bottom falls off in a sheer cliff and the fauna changes with it. The plumose and branching gorgonians of the near-

horizontal bottom disappear and the commonest gorgonian is the single-stranded, whiplike *Elisella* with strands of 12 feet or more. The fish fauna changes too. At the underwater cliff's edge the Fairy Basslet reaches an invisible barrier and is replaced, in the ever-darkening depths, by the Blackcap Basslet. This article is about the discovery, capture and eventual display of the Blackcap Basslet at the New York Aquarium.

Before the advent of skin-diving, the basslets of the genus *Gramma* were thought to be rare or at least uncommon. The loveliest of them, the Fairy Basslet, *Gramma loreto*, was known, but poorly understood. Velvety purplish-blue anteriorly and orange-yellow posteriorly, it is still a favorite among salt-water aquarium fanciers. We know now that it is one of the commonest of fishes in the right localities and habitat. Its geographical range includes the Bahamas, the Caribbean and the deep waters of Bermuda. For some unknown reason, it is not to be found across the Straits of Florida on the Keys or Tortugas. It is characteristic within the range of reefs near or in close communication with the open sea. A few may be found in the lagoons, but only a few. Little groups are most common in caves or under overhangs, largely invisible from the surface and of course too small for line or trap, for the Fairy Basslet, a relative of the giant groupers and jewfishes, reaches a length of only three and a half inches.

Fairy Basslets have strong homing tendencies and are so oriented to their substrate that they are often seen belly up, sidewise or down, whichever is the direction of the limestone wall of their home. Only when they venture out from their cave or overhang — never more than a few feet — do they assume a normal, belly-down fish position. Confronted by the diver, the Fairy Basslet has a distinctive behavior pattern. The entire group faces the diver and may advance with an initial cautious approach, but not into open water and always near the protection of the rock. As the diver approaches further, all dive for small holes in the limey cave, usually pausing at the entrance, then going in headfirst, as if the rock had swallowed them with a dozen little mouths. If one looks into the blind holes, those without back doors, tiny blue snouts and black eyes may be seen peering back. This is the diver's opportu-

nity. With a foot-long plexiglas tube two or three inches in diameter, covered at one end with cloth screening, an entrance is covered. Then with a knitting needle or piece of wire he taps just within the entrance of the hole. Usually the basslet will dash out into the tube. Blocked from escape by the screening, it may dart back and out again with a rapidity that astonishes the would-be capturer. Most fishes have reaction times much faster than human beings and the diver's free hand must be clapped over the open end before the Fairy Basslet makes its escape. With practice, this is not too difficult and the fish is caught. It is then bagged or bottled right there on the bottom. A good fisherman can get a basslet every five minutes in this fashion in the best locality.

Back in January, 1958, Dr. John E. Randall and I made a dive at the region of the 100-foot dropoff at a spectacular locality east of Little Wax Cay in the Exumas of the Bahamas Islands. We were members of a Zoological Society expedition to the Exumas for the purpose of recommending the area as a national park to the Government of the Bahamas (*Animal Kingdom*, Volume 61, pages 34-39). There, the shoals are particularly well-developed and the cliff to the depths almost vertical. Fairy Basslets were extremely common on the 70-to-90-foot horizontal bottom. Every cave and every ledge held its little group of them. But at the cliff's edge they stopped. As if an invisible wall had been erected, a new all-blue basslet with a black cap suddenly appeared, although at the very edge some colonies contained members of both species. Jack Randall swam down a bit further than I and as we later clambered back on deck of the schooner above, he reported excitedly that only the blue basslet was to be found on the cliff face. I knew only that I had seen a fish new to me, but Jack had recognized this as a fish entirely new to science. New? But this was the commonest fish of the vertical cliff! Later, it was shown that not only did the Exumas have bounties of Blackcap Basslets, but it is common on cliffs right off Nassau where almost half a million tourists, many of them divers, go annually. The Blackcap Basslet was finally described scientifically in 1963 by Dr. James E. Böhlke and Dr. Randall in the *Proceedings of the Philadelphia Academy of Sciences* and was given the name *Gramma melacara*. On the surface, it



proves to be a purplish-blue, almost lavender, with tiny yellow spots in the centers of each body scale and with a black cap which runs from the tip of the nose to the top of the dorsal fin. The fins are even longer and more velvety than those of the Fairy Basslet.

The obvious next step was the capture of living specimens and their exhibition to the public. This was not so simple. For one thing, a diver's time at 100 feet is limited to one 25-minute non-decompression dive per day. For another thing, a fish caught at such a depth cannot be brought immediately to the surface without great risk of killing it, due to the expansion of gases in its swim bladder. Relief may be given either by puncturing the swim bladder at the surface, as is commonly done by fishermen who use live wells in their boats, or by bringing the fish up slowly enough that excess gas is absorbed and

excreted by the fish; that is, the fish is allowed decompression time. It is a common belief that fishes transgress the depths of the sea as easily as we do the heights of the air. This could hardly be less true. Fishes are held to certain depths by their physiology and it takes them some time, in the species with swim bladders, to ascend and descend, particularly near the surface where proportional pressure change is most dramatic. Descending 15 feet into water changes pressure approximately as much as ascending 18,000 feet in the air; the difference is 0.5 atmosphere, or 50% in either case.

In November of 1962 Jack D. Gabow and I embarked on a 36-foot boat for the Exumas, to the spot where Jack Randall and I had first seen the Blackcap Basslet. We were armed with plastic tubes, nets, knitting needles, straightened-out coat hangers, plastic bags and cameras. We went

over the side above the dramatic dropoff and at 80 feet hit bottom. This was a world of pastel blue clarity and brilliance. As we touched bottom, a six-foot Green Moray swam over to us, took cover in the reef, only its head showing, and gaped a wicked-looking welcome which was actually only a gulping of water for respiration. Groups of Fairy Basslets were everywhere. We swam east for the edge, toward the massifs where the horizontal world would turn suddenly vertical. We peeked over the edge and a Nassau Grouper, belly to the cliff, looked at us from a

blue and seemingly bottomless ocean. Right at that edge the Fairy Basslets stopped and I felt what I always feel upon seeing the Black-capped, deep-water species whose roof is an undefinable layer almost 100 feet down. Only exactly at the edge did the two species commonly mix. Seemingly they are of identical habits, but definitely standoffish in some behavioral or ecological way toward each other.

We went over the edge to 120 feet and felt the gentle downward sweep of ebbing water from the banks westward. This might become strong and even dangerous at full ebb. Jack took movies while I wielded the tube and wire, penning basslets in small holes and rapping at their front door with the wire as the tube was held over the hole. Several swam all the way into the tube and out again before I could drop the wire and cap the open end with my hand. But we did capture and bag three in our twenty-minute dive. Then we began our ascent ever so slowly. At the surface, after about five minutes, all three

***With wire probe and plexiglas tube
Dr. Ray prepares to capture a bass-
let that has taken refuge in a cre-
vice in the steep underwater shelf.***

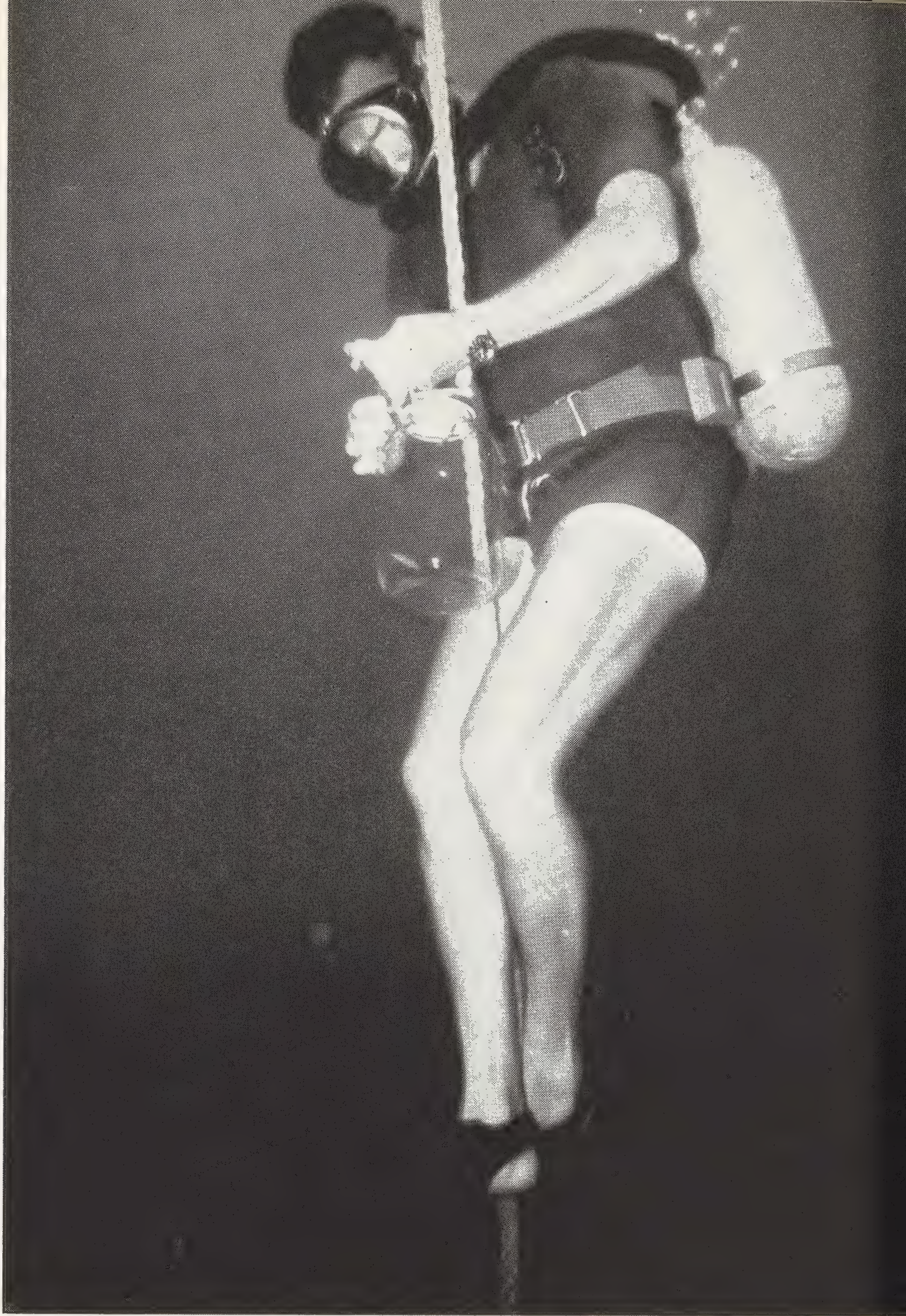
Both photos by Jack D. Gabow

***Once captured in the tube, the fish is
transferred under water to a plastic
bag for ease of transport to the sur-
face. Here Dr. Ray makes a transfer.***



Surfacing slowly while the fish adjusts to changes in pressure, Willie Meyers brings up one of the fish now in the Aquarium.

Photo by the Author



fish were swollen with gas, but apparently not damaged. We punctured their swim bladders with a small pin and released the excess gas and all three made it to New York where they lived for a few weeks. Later we found that our exhibition was slightly anticipated by Henry Feddern of the Institute of Marine Science of the University of Miami, who had caught a few blackcaps a couple of months before.

Last spring we tried again, this time with Willie Meyers and Peter Higgs of Nassau, and caught three more, one of which survives in a small tank on the south wall of the Aquarium — five months, a record so far for the species, to our knowledge. It lives with several Fairy Basslets and Yellowheaded Jawfish in perfect harmony. This time we bottled the fish and brought them

up more slowly, 15 feet every 5 minutes, and as a result only a slight swelling occurred which the fishes themselves rectified in a few hours so that no punctures were necessary.

What keeps the Blackcap and Fairy Basslets apart? Is it the difference in light on the horizontal and vertical slopes, such as we see on northern- and southern-facing slopes here in the northeast? The Blackcap Basslet is a true indicator species of the cliff face from 90 to 150 feet, in my experience. The Fairy Basslet is rarely found on this slope. We hope to study these species at the edge and below, for we suspect that the habitat preference will indicate some basic value in understanding why some species of marine organisms are distributed in so strange a fashion.

News from the Conservation Foundation

“Pesticides and the Living Landscape” Is New Book by Robert Rudd

To the hotly debated controversy over the widespread use of chemical pesticides comes a new book written by Robert Rudd, under the sponsorship of the Conservation Foundation. The study examines the nature and effects of pesticide use and is based on a thorough coverage of available statistical and analytical data. Mr. Rudd is well qualified for the task. As a professional zoologist with a long-standing interest in population phenomena and game management, he has had first-hand acquaintance with the pesticide problem in California during a four-year period from 1952 to 1956 and has participated actively with individuals and organizations interested in pest control since that time. His book is rich in its variety of examples, ecological in its thinking, and honest in its avoidance of scare literature.

In broadest terms the book describes two things: how man fares in the biological competition with infectious, nuisance, predatory and depredating creatures; and the price he pays for the methods he uses in combating them. The failure to consider fully the consequences of the intrusion of toxic chemicals into biological or ecological systems is given particular emphasis, and both use and consequence are examined in terms of the general welfare.

The book was published by the University of Wisconsin Press in August.

Persistence of DDT in Soils

The last of a series of field studies by George Woodwell on the cycling of pesticides through soils and waters was summarized in the July issue of *Science*. The series has been underwritten by the Foundation over a period of five years. Soils from DDT-sprayed forest stands in New Brunswick and Maine were found to contain DDT residues. The residues increased in successive

samplings between 1958 and 1961, although no new spray was applied. This increase suggests that DDT residues may persist for several years in tree canopies but are ultimately carried into the soil.

Environmental Administration

On August 1 Dr. Lynton Caldwell of Indiana University began a one-year study of environmental issues as a new focus for public policy. The book expected to result from the study will be directed at an audience which is unfamiliar with the utility of ecological concepts and approaches relating to issues of environmental deterioration, change and development. Dr. Caldwell will attempt to interpret the ecologist's view of environmental problems for government officials in policy-influencing positions and university officials who are concerned with the exploration of new directions in research and teaching in which there might be a closer partnership between the policy sciences and the science of ecology.

Briefly Noted

F. Fraser Darling attended the July International Biological Program meeting in Paris. . . . William Vogt was present at the Fifth International Planning Congress in Mexico City in September. He will also arrange an October meeting of the steering committee for the Foundation-sponsored Central American Resources Study Conference. . . . Martha Munzer attended the meeting of the Conservation Education Association in Seattle and directed one of the panels. . . . Paul Brandwein spent August in Hawaii serving as consultant to the Office of Science Education, State Department of Education. . . . Noel Eichhorn represented the Foundation at the August Conference of the American Institute of Planners in Newark, New Jersey.

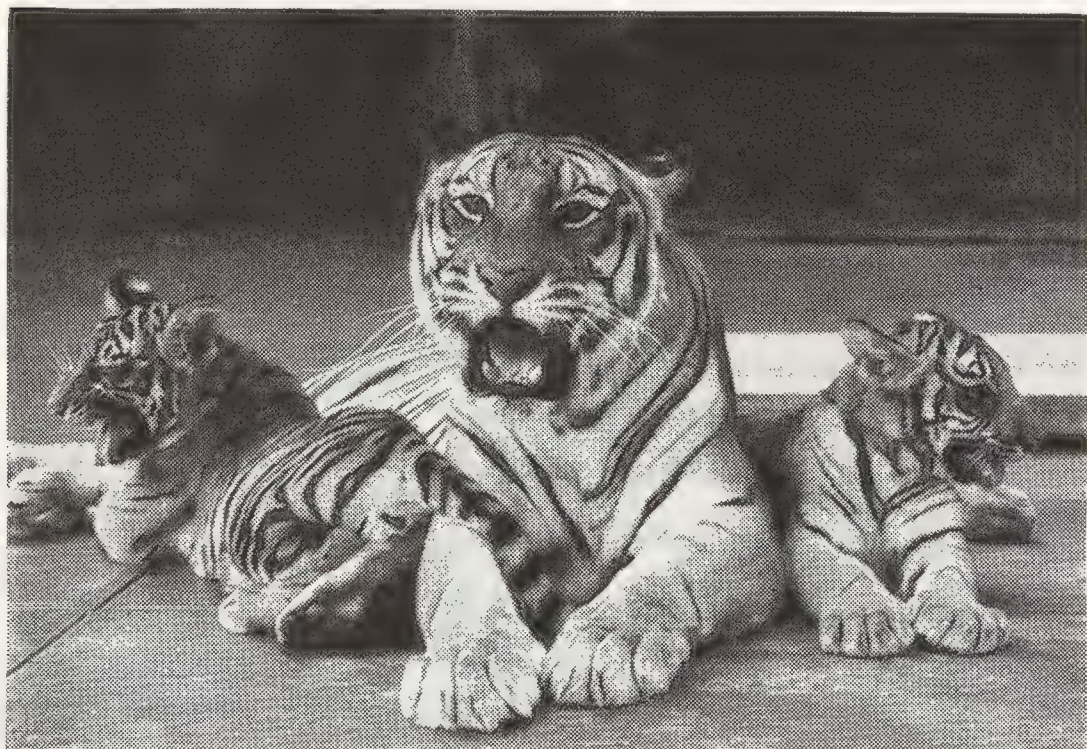
BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM
AND THE DEPARTMENT OF TROPICAL RESEARCH

A Peaceful End for Old Dacca After 20 Years in the Zoo

Dacca, our Bengal Tiger mother of 32 cubs, is no more. After being in the collection for 20 years, 7 months and 2 days, she was obviously failing fast and on September 10 euthanasia was decided upon and carried out. She may hold the world's record for Tiger longevity, although a Tiger in the Rotterdam Zoo was said to be 20 years old early this year and is believed to be still living. In any event, Dacca's place in the annals of the Bronx Zoo is secure.

Dacca and two brothers were born in the Zoological Park on February 8, 1944, to Prince and Jenny. Jenny had not proved herself to be a successful mother, and so when her third litter was born the three cubs were "lifted" and turned over to Mrs. Helen Martini, the wife of the Lion House keeper, for hand-rearing. It was she who named them: Dacca, Rajpur and Raniganj. For the first three months they lived in the Martini apartment across the street from the Zoo and were frequently and enthusiastically photographed by newspapers, newsreels and magazines. Writing in *Animal Kingdom* at the time, General Curator Lee S. Crandall described the cubs perfectly. Rajpur, he wrote, was "slow, fat, lazy and good-natured;" Raniganj was "furtive and unpleasant;" little Dacca he unhesitatingly characterized as



A picture of dignified maternity: Dacca at the height of her career as the mother of 31 cubs.

"a hoyden, always sweet." Those attributes remained with them throughout their lives.

At the age of about three Dacca showed a strong preference for Rajpur and they were allowed to mate; Rajpur was the father of all her subsequent cubs.

Litter	Date	M	F	Disposition
1st	May 4, 1948	2	2	Died at birth (1) Chicago Zoo (3)
2nd	May 6, 1949	1	2	Baltimore Zoo (2) Fort Worth Zoo (1)
3rd	May 18, 1950	2	1	Philadelphia Zoo (2) Died (1)
4th	May 10, 1951	—	4	Milwaukee Zoo (2) Los Angeles Zoo (1) Lincoln Park Zoo (1)
5th	May 1, 1952	2	2	Pittsburgh Zoo (3) Salt Lake City Zoo (1)
6th	May 24, 1953	3	—	Died at Birth (1) Cleveland Zoo (1) Staten Island Zoo (1)
7th	May 7, 1954	4	—	Died (1) Taronga Park Zoo, Sydney (1) European dealer (1) Rochester Zoo (1)
8th	June 3, 1956	2	—	Columbus Zoo (1) Birmingham Zoo (1)
9th	May 3, 1957	2	—	European dealer (2)
10th	Nov. 8, 1958	1	1	Retained (1) Columbus Zoo (1)
11th	Nov. 14, 1959	—	1	Miami Zoo (1)

Euthanasia was decreed for Rajpur on October 5, 1961, when his health failed. Previously, Raniganj had been disposed of to an American dealer in animals, on July 17, 1959. We now have, as a living reminder of Dacca, only the daughter of her tenth litter, a handsome, healthy six-year-old appropriately named Dacca II. The original Dacca added a new dimension to our knowledge of Tigers in the Zoo, and there are those who will miss her.

Summer's End; or, What to Do with Unwanted Reptiles

Just as spring brings daily inquiries to the Bird Department: "I have a baby bird that fell out of

the nest. What shall I feed it?" so the end of summer keeps the Reptile Department busy advising on the care, feeding and winter housing of toads, frogs, turtles and (rarely) snakes — the inquiries usually prefaced with: "My son has a (toad, frog, turtle, snake) he got at camp. What shall I do with it?"

Advice is easy to give but the traffic is two-way; the Reptile Department gives advice to all who enquire by telephone, but it is on the receiving end when juvenile herpetologists show up at the Zoo with reptiles they brought home and are not allowed to keep. In the week before and the week after Labor Day we received donations of Garter Snakes, Water Snakes, Western Painted Turtles, Box Tortoises, Snapping Turtles, Bull Frogs, Green Frogs and one Diamondback Terapin. Two iguanas were also offered and accepted, but they seem to have been acquired at a pet shop. Iguanas, as so many people find, are not really very amusing pets.

If the seekers after advice seem completely lost and unable to cope with their reptile problem, we generally end the conversation with: "Of course, if you find you simply can't take care of your (toad, frog, turtle, snake), bring it to the Zoo and we'll accept it as a donation."

The response is always the same. "Oh, *will* you? Oh, thank you!"

IN BRIEF

Predator Study. A 12-page pamphlet entitled "A Preliminary Study of Distribution and Numbers of Cougar, Grizzly and Wolf in North America" has been prepared by Dr. Victor H. Cahalane, Assistant Director of the New York State Museum, and has been published by the Zoological Society. It was financed by a grant from the Society and the Boone & Crockett Club.

Closing Date. The Children's Zoo in the Zoological Park will close for the season on the evening of Sunday, November 1.

Another Wisent Baby. A female calf was born to our pair of Wisents, or European Bison, on September 22nd. She has been named Nerita — the first two letters in her name indicating in the world pedigree book of Wisents that she was born in the New York herd. We now have four Wisents, including the parents and last year's calf, Nerissa.

PUBLICATIONS OF INTEREST

THE GREAT ARC OF THE WILD SHEEP. By James L. Clark. Foreword by S. Dillon Ripley. Illustrated in black and white by 89 photographs, drawings and maps. Pp. xxxvi + 247. University of Oklahoma Press, Norman, 1964. \$6.95.

Throughout a lifetime devoted to the diligent application of many skills as sculptor, master taxidermist and sportsman, James L. Clark has clung tenaciously to a deep interest in the wild sheep of the world. To seek them in their remote, precipitous haunts, he has undergone hardships and privations beyond the endurance of lesser men. He has photographed them, reproduced their beautiful forms in enduring bronze, mounted them in magnificent museum exhibits and now, at last, he has given us this superb account of a rapidly vanishing group, replete with anecdotes from his own experiences and those of many others. The Great Arc, spreading its mountainous curves from the Mediterranean to eastern Siberia and from Alaska to Baja California, has found an able and devoted historian in this hardy veteran of the mountain trails. — L.S.C.

SPOTTED SALAMANDER. Text and illustrations by Robert M. McClung. 48 pp. William Morrow & Co., New York, 1964. \$2.75.

Another book in the now extensive series of life histories of animals, for children, written by Mr. McClung. It includes two pages of instructions for keeping salamanders as pets.

ADVENTURE LIT THEIR STAR. By Kenneth Allsop. Illustrations in black-and-white by Antony Smith. 222 pp. Crown Publishers, Inc., New York, 1964. \$3.95.

When first published in England in 1949, this engaging account of the establishment of the Little Ringed Plover as a breeding British bird achieved an immediate success for its excellent prose and detailed observation. Allowed to lie dormant for some years, the book was republished in England in 1962 and the present American edition will certainly be well received. The general style is fictional, recounting the actual and presumed adventures of the birds in accomplishing the sometimes successful rearing of their broods and involving dedicated human observers as well. The factual descriptions are basically accurate and the reactions of the watchers will appeal to all "birders." As far as the birds themselves are concerned, some almost unavoidable anthropomorphism has crept in but this should in no way detract from enjoyment of this simple but altogether charming tale. — L.S.C.

FACE OF NORTH AMERICA. The Natural History of a Continent. By Peter Farb. Drawings by Jerome Connolly, photographs. 316 pp. Constable, London, 1964. 45 shillings.

The English edition of a book published last year in America by Harper & Row. Explanations and discussions of the geologic forces that have formed the continent, of the seashore, inland waters, mountains, forests and drylands, and comments on man's agency in changing the face of the land. An Appendix lists outstanding natural areas in all states and Canadian provinces.

THE LAND AND WILDLIFE OF SOUTH AMERICA. By Marston Bates and the Editors of *Life*. 200 pp., profusely illustrated in color and black-and-white. Life Nature Library. Time, Inc., New York, 1964. \$3.95.

An especially notable volume in this remarkable series — not only for the illustrations but for the quality of Marston Bates's writing about a continent he knows well.

SILENTLY BY NIGHT. By Russell Peterson. 227 pp., many drawings. McGraw-Hill, New York, 1964. \$6.95.

Mr. Peterson, formerly on the staff of the American Museum of Natural History, writes delightfully — breezily and informatively — about the bats of the world. The “singular purpose” of the book, as he puts it, is the “transposition of the animal from myth to fact.”

LIFE HISTORIES OF NORTH AMERICAN FLYCATCHERS, LARKS, SWALLOWS, AND THEIR ALLIES. By Arthur Cleveland Bent. 555 pp., 70 plates. Dover Publications, New York, 1963. \$2.75.

LIFE HISTORIES OF NORTH AMERICAN WOOD WARBLERS. By Arthur Cleveland Bent. Part 1: Pages 1-367, plates 1-44; Part 2: Pages 367-734, plates 45-83. Dover Publications, New York, 1963. Each part, \$2.50.

A welcome continuation of the inexpensive facsimile reprints of Bent's “Life Histories,” those cornerstones of an ornithologist's library. Of the 20 volumes originally published by the Smithsonian Institution (some of which are now difficult to find), 9 have now been given unabridged reprinting by Dover. Printing of the text leaves nothing to be desired; the plates are less than perfect, but usable. (Plate 42 in Part 1 of the Wood Warblers is upside-down.)

FAMILIAR REPTILES AND AMPHIBIANS OF AMERICA. By Will Barker. xix + 220 pp., 4 col. pls., numerous text-figs. Harper & Row, Pub., New York, 1964. \$5.95.

Another of the current spate of books on reptiles and amphibians written by persons who have only a superficial knowledge of the subject. It is not a bad example of its kind. The drawings by John Cameron Yrizarry are better than most and the text is remarkably free from major error, either technical or typographic. Unfortunately, the information is strung together in a series of uninspired species accounts. A more judicious selection of species and some underlying concept of arrangement, taxonomic, ecologic, or geographic, would have made the minor amount of natural history presented much much more meaningful — and perhaps more interesting. — H.G.D.

Other Books Received

THE LIFE OF INSECTS. By V. B. Wigglesworth. Photographs in color and black-and-white, many drawings. 358 pp. World Publishing Co., Cleveland, 1964. \$12.50.

THE BASIS OF HUMAN EVOLUTION. By Bertram S. Kraus. 384 pp., drawings by Virginia E. Brooks. Harper & Row, New York, 1964. Cloth, \$6.50; paper, \$4.75.

HOW TO USE A MICROSCOPE. By W. G. Hartley. 255 pp., 135 drawings. American Museum Science Books. The Natural History Press, Garden City, N. Y., 1964. Paperback, \$1.45.

New Members of the New York Zoological Society

(Between July 1 and August 31, 1964)

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An Open Letter to New Member #601 of 1964

Dear Member:

We don't know who you are, but we can safely predict you will join the New York Zoological Society by the time this issue of *Animal Kingdom* reaches our present Members. New Member #600 joined the day we went to press and increased our total to 4,924, an all-time high in the Society's 69 years.

Your Membership will be important to the Zoological Society for the very good reason that you, too, are a friend of wild animals. They need friends.

We are glad to have you with us. We promise to keep in touch through *Animal Kingdom*, special reports and Newsletters. We'll see you, we hope, at Garden Parties at the Zoo or the Aquarium, or at the mid-town, mid-winter Members' Meeting. Perhaps at the Curators' Tours next spring, too. We hope you will be thrilled every time you visit the wonderful wild animals at the Zoo and Aquarium.

You are giving us a lot more than your Membership dues and extra contributions. They're important to the Society's work in education and research and conservation, of course. But the main thing is the banding together of people who are friends of the hard-pressed wildlife of the world.

Sincerely,

GORDON CUYLER

Membership Chairman



VOL. LXVII • No. 6 • NOV.-DEC., 1964

ANIMAL KINGDOM

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THE MAGAZINE OF THE NEW YORK ZOOLOGICAL SOCIETY

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ANIMAL KINGDOM

Bulletin of the
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The Aquarium—On The Way!

MORE THAN 200 million people have come to the Zoological Park and the Aquarium since the former was opened in 1899 and the latter came under the Zoological Society's administration three years later. Still they come, at the rate of some three million a year. Times change, city life becomes the lot of almost everyone, a host of new leisure-time "attractions" appear — television, movies, and a spate of others — yet the fact remains that people have constant and undiminished interest in the wonders of animal life.

In last month's issue, the leading article, as well as this editorial, dealt with the new exhibit building for aquatic birds at the Zoological Park that was opened in the autumn. This is the first of a number of new buildings and exhibits to be constructed as part of our General Development Program. These also will employ new and imaginative concepts for exhibiting animals in environments resembling as nearly as possible those existing in nature.

Similarly the Aquarium is engaged in far-reaching plans for the future, of which a general definition will be found in this issue. Our goal is to make both the Zoological Park and the Aquarium the most remarkable institutions of their kind.

Fairfield Osborn

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Above — Incoming birds are careful to pin-point their own nests before alighting lest they get into trouble from neighbors. Right — Uninhabited Cat Island is low-lying, with easy beach landings. Picture from Babel Island shows huts used by “mutton-birders.”

All photographs by the author

Five Months on Cat Island with

THE GANNETS OF BASS STRAIT

By JOHN WARHAM

THERE IS no better way of getting to know the ways of animals than to live with them. My wife and I, then, were fortunate when studying gannets to be able to share a breeding island for five months of the nesting season. As the colony was small we soon came to know its members as individuals and through daily watches, some of which lasted from dawn to dark, we succeeded in uncovering a good deal that was new about these attractive and lively sea-birds.

Our gannet home, 100-acre Cat Island in eastern Bass Strait between Tasmania and Australia, was low-lying and in fine weather a beach landing was no problem. Elsewhere, and more typically, gannets generally choose islands bounded by steep cliffs, as they do, for instance, at Bonaventure in the Gulf of St. Lawrence or at Pyra-

mid Rock in Tasmania. As a matter of fact, the future of the Cat Island birds would have been brighter had they adhered to a more conventional and less accessible site; human predation has almost destroyed their Bass Strait colony.

When the first count was made in 1893, there were about 2,500 nests. Such high numbers have never been recorded since. The deterioration began well before World War II when fishermen discovered that they could easily kill the nesting birds and use their flesh to bait their pots. Despite efforts to curb this primitive practice, it has continued up to the present time. With the gannets almost gone, Little Penguins and Short-tailed Shearwaters are used nowadays, illegally of course; the penguins are said to make the best bait! Our visit was sponsored by the Tasmanian Fauna Board which was anxious to halt further



slaughter, but the colony was by then very tiny. Only 16 chicks were reared that season and the maximum number of gannets based on the island was only about 80. Of these many were non-breeders.

Gannets are large black and white birds of temperate seas. Most familiar is the Northern Gannet breeding along the coasts and islands of the North Atlantic, but very similar although completely isolated populations of gannets that have developed slight plumage differences nest around South Africa and around southern Australia and New Zealand. All are closely related and they are often grouped together as a single species, *Morus bassanus*, with three subspecies. This is the usual treatment in North American texts but in my opinion we need to know a good deal more about the behavior, genetics and biochemistry of gannets before we shall know whether or not these isolated breeding groups have differentiated sufficiently to be good species. I prefer, therefore, not to lump them together, but to emphasize their differences by keeping each as separate species — the Northern Gannet *Morus bassanus*; the Cape Gannet *M. capensis*, and the Australasian Gannet *M. serrator*.

In appearance the Australasian bird differs from the northern one mainly in having both the

secondary and primary wing feathers and the central tail feathers black, whereas in the Northern Gannet only the primaries are black. Two Cat Island chicks were found to have attained full adult plumage only two years after hatching and if this is general it may represent a constant difference from the northern birds, for these appear to take four years to acquire adult plumage.

Most of the non-breeders at Cat Island, although in adult plumage, were probably too young to breed — they were pre-breeders. Such birds were extremely active in display and many had acquired nesting mounds and were going through the motions of breeding while their more adult neighbors incubated or brooded nearby.

These pre-breeders gave us clues on how pair-formation takes place, for we had arrived too late to see the re-occupation of the colony after the gannets' winter at sea. A pre-breeder, probably a male, would occupy a nest mound at the edge of the colony and here it would stand for long periods. From time to time other gannets would fly over or would waddle past and if the pre-

The gannet colony on Cat Island is now very small although there were about 2,500 nests in 1893. Sixteen chicks — these are some of them — were reared in the whole season the author spent there.

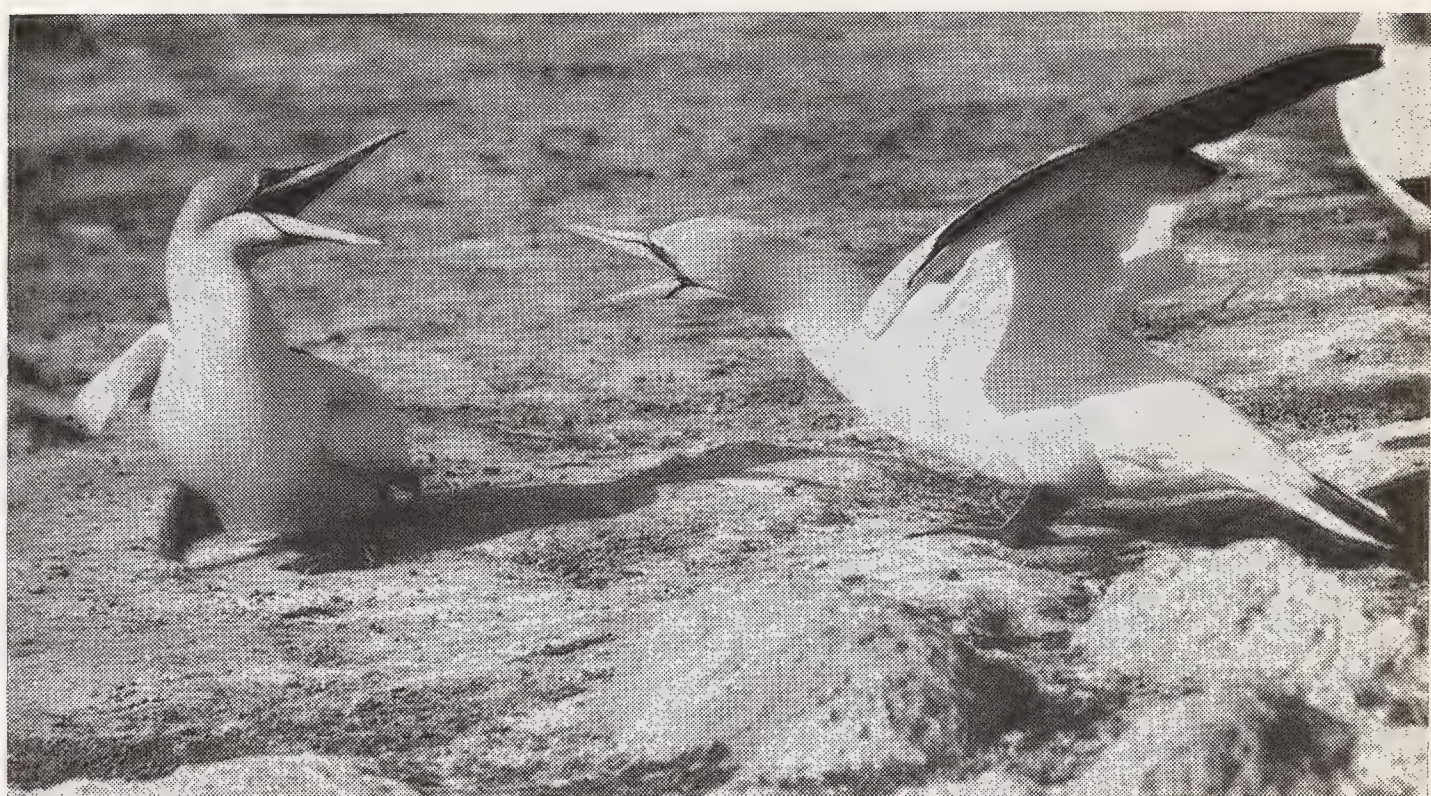


breeder was keen to win a mate, it would wave its upraised head from side to side in a watered-down version of the greeting ceremony to be described later. The passer-by might be a breeder going off duty; if so, it would ignore these solicitations. But it might be another and unattached pre-breeder. Such birds often responded by coming closer and waving their heads in a similar fashion. Under favorable circumstances a full and mutual greeting display followed and, in due course, other displays leading to copulation and pair formation. In gannets the tendency seems to be to retain the partner and the nest site from year to year and probably pairs formed by pre-breeders in one season are re-formed in later ones when each member has become accustomed to the ways of its mate. Effective breeding may then begin.

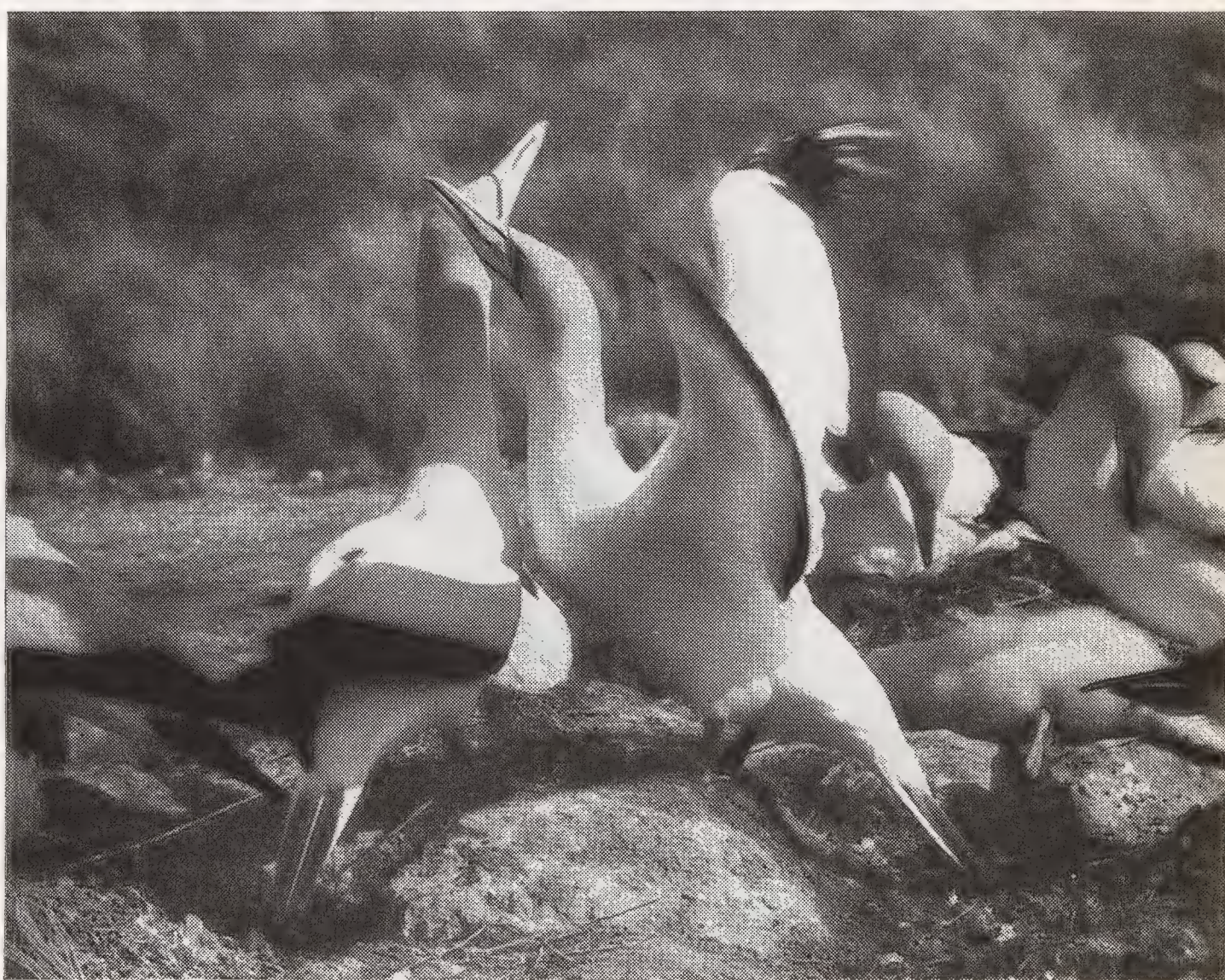
Gannets have a wide range of displays which they use frequently, so that a gannetry is a lively and noisy place except after dark. The commonest action seen was the curtsy. This started when a bird suddenly brought its head up from one flank and, with a twisting movement of the neck, swept its head up until the bill pointed to the sky. The head was then waggled from side to side before being swept down to the flank in another snaky movement and the whole action repeated. As the head swept down the tail was cocked up so that throughout the action the body see-sawed to-and-fro with the feet acting as a fulcrum. Meanwhile the bird called continuously and the calls were anything but musical, being a raucous, jangling "urrah," like the running-out of a rusty anchor chain.

Curtsies were used by birds of either sex and at all stages of the breeding cycle but particularly by singletons on nest-sites: the display seemed to advertise the gannet's ownership of a breeding territory.

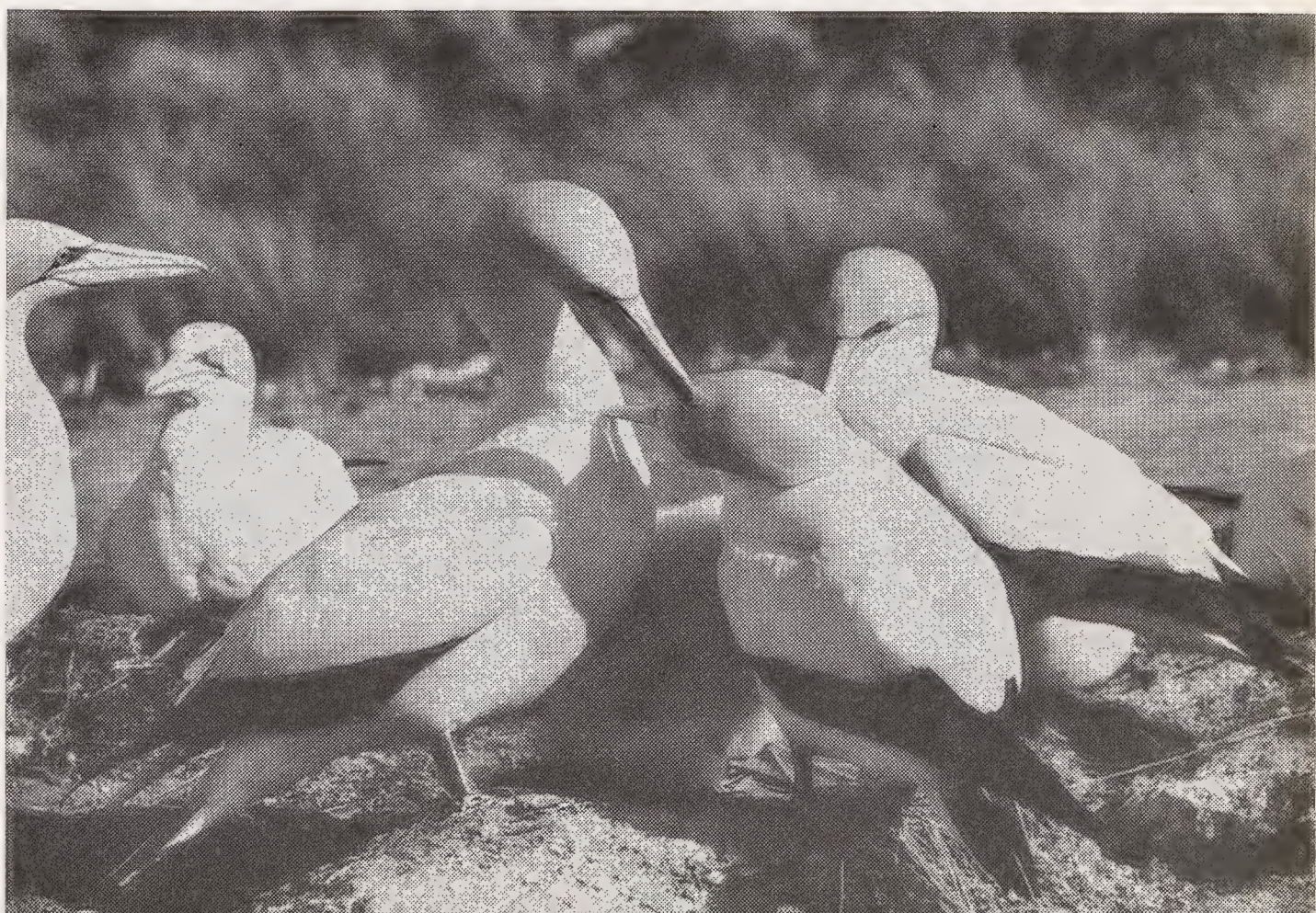
These territories were very small, the ground held by each pair extending only as far as the sitting birds could reach with their bills. The result was a very uniform spacing of the nests at about one per square yard and at large colonies on flat cliff-tops the mounds appeared as if laid out on the squares of a grid. At Cat Island, as elsewhere, the territories were vigorously defended, particularly by the males, and there was a lot of fighting between neighbors, mostly with-



Above — Fights and disputes are commonplace. Both of these birds are pre-breeders. Despite the vigor of their attacks on each other, the squabbling, though dramatic, seldom resulted in real damage.



Above — The greeting ceremony when a gannet joins its mate at the nest. Bird at extreme right is holding the appeasement posture and hides its bill. Below — Mutual preening follows the greeting.



out any harm resulting. Each threatened by thrusting its opened bill forward in a scooping movement to reveal the black interior of the mouth. The sudden display of the dark buccal cavity surmounted by a pair of squinting eyes was quite dramatic and gave the bird a rather diabolical appearance, at least to human eyes.

On its nest mound the owner-gannet reigns supreme. Should another stumble into the sitting bird, the latter attacks viciously and the intruder usually flees without delay. But when the owner's mate arrives, this special bird is promptly accepted. Our colony was too small and valuable to permit any experimentation but we gained a good deal of indirect evidence that the birds recognized their mates at a distance. For example, on numerous occasions a gannet that had been quietly sitting suddenly became alert as another appeared over the colony and called loudly in readiness for alighting. Often no other sitter took much notice and on these occasions the incoming bird nearly always proved to be the partner of the one alerted.

The voices of the gannets varied quite appreciably from one bird to the next and as we could soon recognize some individuals by voice alone, it seems likely that the birds themselves could do this, too, particularly as the breeders had probably been keeping company for several seasons. In addition, it is well known that birds can detect very slight differences in features and facial expressions, and although we could not tell one gannet from another merely by looking at them, (except through idiosyncrasies of display), it seemed quite possible that the gannets could do this and that visual as well as vocal clues were used in individual recognition.

Gannets take turns in incubating the egg and in guarding the chick, the off-duty bird feeding and resting at sea. On returning such birds usually made several flights over the colony before alighting directly by their nests. This seemed a very sensible system to avoid the bills of other nesters, which were only too ready to use them if a neighbor came within pecking range. Just before alighting the gannets hung in mid-air, picking out their positions carefully, while some of the birds below turned their bills upward ready to go into action if the incomer put a foot wrong.

On reaching its mate the relieving bird im-

mediately went into a noisy display in which the other joined. This was the greeting ceremony already mentioned. The birds pushed up so that their breasts touched and they waggled their raised heads from side to side so that their beaks clattered together. At the same time they ground out their loud "urrah" cries. This display soon abated and for a while the two preened each other's head and nape, then they preened themselves, and finally they relaxed. Sooner or later they changed over and the relieved bird departed.

At a small colony such as this, the care taken by incoming gannets to ensure that they touched down at their own nests seemed a little unnecessary. But at flourishing gannetries where there are thousands of nests the problem of locating the correct one must be quite acute. Even at Cat Island mistakes occurred. Occasionally a breeder would not alight at its own nest but at the one next door. The result was immediate attack by the outraged owners if either was at home, sending the erring gannet post-haste to its rightful nest.

Although I believe that members of a pair recognized one another, a mate was not accepted unless he or she performed the greeting ceremony

In the flying-up posture, the head is raised, eyes peer forward from under the bill and the bird marks time as it slowly rotates until it is headed toward a clear space and can make an unimpeded departure

as soon as it alighted. This performance seemed to clinch the recognition. If, as sometimes happened, the newcomer failed to display, it was attacked by its partner. It would then break into the greeting ceremony and all would then be well.

To get out from a mass of aggressive birds is almost as big a problem at large colonies as to land in the right place and departure was accompanied by a stereotyped attitude — the flying-up posture. Relieved birds did not simply push their way out through the colony nor, unless the wind was strong, did they take off directly from beside their nests. Instead, such birds pivoted around, marking time with their big flat feet while their necks were stretched high and tilted back so that they could peer forward as if searching for the best way out through the maze of nests. When birds turned towards my observation blind I



could see that they brought both eyes to bear binocularly from under their bills as a bittern does when it "freezes." Apparently this manoeuvre enables them to judge how far they have to go to reach the nearest open space, for presently out would shoot their wings and the birds would bound upwards to alight about two yards away, still retaining their statuesque postures. They were now usually clear of threatening bills and could depart with a normal take-off.

These Australasian Gannets kept long watches at their nests. During incubation I found that their stints lasted about 27 hours but after the hatch these were significantly shorter, averaging around 12 hours. If we arrived at the colony to find both parents present at a nest, it was generally a simple matter to tell which had recently arrived as this bird's feet would be clean and

would look very handsome, for the black webs are picked out with bluish-green lines running down the tarsi and along each toe. In contrast, those of the on-duty bird would be so smeared with guano that the patterning was quite obscured. Their soiled condition evidently did not go unheeded, for when the relieved birds finally flew out to sea they invariably dunked themselves repeatedly in the waves before shaking the water from their plumage and heading in steady flight towards their more distant feeding grounds, freed now from the filth of the rookery.

The gannet's bill makes a dangerous weapon. Deaths and serious injury are, however, probably reduced by the use of special appeasement postures. The most frequently noted of these concluded a series of curtsies or bouts of fighting. The head was bowed and the beak tucked away

so as to be almost hidden in the breast feathers, and while in this posture the bird remained motionless. The attitude seemed to suggest that the incident just past should be considered closed and it was followed by a return to normal non-aggressive behavior.

Beak-hiding as a deterrent against attack occurs with other sea-birds, with crested penguins, for example, and gannet chicks used a form of beak-hiding too. A large chick alone on its nest was suddenly attacked by a pre-breeder. Presumably wanting to take over the site, this bird began driving its bill into the chick's neck. The latter immediately subsided and kept quite still, with its neck outstretched and its bill turned away from the attacker. Intermittent pecking followed for several hours until eventually the chick tucked its bill right under its body, resting its forehead on the rim of the nest. Its beak was now completely hidden and the attacks eased a little thereafter. The chick must have found breathing difficult in this restrained posture and its body heaved in consequence, but it managed to hold the attitude for over an hour until one of its parents arrived and at once put the aggressor to flight.

Chicks that at an age of about 40 days started

to wander from their nests were often preened and accepted temporarily by other adults. Some parents, however, assisted by their chicks, attacked these wanderers, sending them into the submissive attitude. The adults' assaults then ceased but not those of their chicks, so that an adult might be preening the head of a visiting and now prostrate chick while its own youngster continued to deliver a series of violent jabs. It seemed that while the adoption of the submissive posture was innate, the correct response to this had to be learned. And even where adults were concerned, the posture did not confer complete immunity; protective mechanisms are not all-or-none devices — toads will gorge on poisonous blister beetles and birds eat warningly colored insects. Nevertheless, if such stratagems confer even slight advantages to their users, they may be selected for in the course of evolution.

Like other fish-eating birds, gannets swallow their prey head first so that fins and spines do not catch in their gullets. We were interested to

Gannets guard their chicks even when they are seemingly large enough to be left alone. They may be too large to be covered properly but the parent bird makes an attempt anyway.





discover whether the fish were turned around before being fed to the chicks. Fortunately the parent's and chick's bills often separated during regurgitation, leaving a fish sticking out momentarily from one of them. We then saw that the fish were not being reversed but were disgorged tail first and swallowed tail first by the chick. The presence of copious mucus probably acted as a lubricant to prevent damage from spines.

Food that was spilled was never retrieved by the gannets but the colony had its own small coterie of Silver Gulls which acted as cleaners to the community and were nimble-footed enough to dodge the javelin bills of the bigger birds. The gulls gave us an interesting insight into their learning ability. However cautious our approach we could not avoid scaring off some of the pre-breeders when we had to check the colony and so we gave the gulls some extra meals, as such gannets often regurgitated before flying. Soon the gulls learned to associate our appearance with a meal. If they were not already at the colony they would come streaming toward it as we approached, sounding their food call. In turn, the gannets came to associate these calls with us, and the non-breeders especially came to be more nervous of the gulls' cries than of more real dangers such as passing sea-eagles or harriers.

This well-feathered chick is in a submissive attitude while being attacked by an intruding pre-breeder. Finally it turned its head under its body to hide its beak and inhibit the attack.

We banded the chicks shortly before the eldest appeared ready to fly. This involved a good deal of disturbance. Those adults present fled and the chicks all moved from their nests during the operation. None was back in its proper place when the old birds started to return and several hours went by before the displaced chicks had sorted themselves out. But eventually they all did, although some had to run the gauntlet of five or six adult beaks and needed to use their submissive displays before gaining the safety of their nests. Several of the chicks had never been away before and their success in returning showed that they had acquired an excellent sense of position. The need for this ability probably arises because no meals are served to young gannets except at the correct nest site. Thus a straying chick that cannot locate its nest or fails to react to its parent's calls will starve, for other gannets will not feed it. Such individuals are therefore eliminated from the population at an early age, long before they have any chance to leave progeny of their own.

In No Danger of Extinction:

THE SNOWSHOE HARE

By DAVE MECH



ONE NIGHT while lying in a sleeping bag in Isle Royale National Park, I awakened with a feeling of pressure on my chest. Without arising, I glanced downward and felt the load shift slightly. Still groggy, I finally recognized the form of a Snowshoe Hare settled comfortably atop me, perhaps snoozing as deeply as I had been. When I propped up on my elbows for a better view, the hare sprang off and bounded into the brush. I related this experience to my companions the next morning, and learned that they too had had a visitor in the night, but had not gotten off so lightly. The hare had eaten their rawhide shoelaces.

No doubt shoelaces do not compose a very large part of the Snowshoe Hare's diet. In fact, rawhide is downright exceptional, and the usual fare is grasses, leaves, ferns, buds and berries in summer; and twigs of cedar, balsam, spruce, alder, white birch, mountain ash, shadberry and other woody plants in winter. Hares obtain moisture in winter by eating snow, and in summer, at least in captivity, they consume about a cup of water per day.

As an exercise in patience, I recommend Snowshoe Hare-watching, for while the hare is foraging, it sets a remarkable example of watchfulness itself. Every few bites a hare takes, it stops, twitches its nose, perks up its ears and perhaps rises on hind legs. Hares can stand motionless in mid-bite for several minutes at a time, a behavior that has great survival value. One false move and a Snowshoe may find itself lining the stomach of a bobcat, lynx, fisher, fox, wolf, coy-

In its winter coat of white the Snowshoe Hare has some protection from an enemy's eyes.

Photo by the author.

ote, hawk or owl. In the North country, the Snowshoe Hare is the favorite prey of all these predators except the wolf.

Wolves do take hares occasionally, but rely more on big game. I have watched both a lone Timber Wolf and a pack of 16 flush a Snowshoe and then ignore it as it ran off. On the other hand, I once observed seven wolves in northeastern Minnesota chasing a hare. They cornered it under a thick blowdown and surrounded it. With wagging tails, the wolves worked around the blowdown for several minutes before giving up.

Whereas a Snowshoe Hare, weighing only 3.5 to 4.5 pounds, would provide only a part of a day's meal for a wolf, it probably would fill a fox for a few days. Thus a hare would be a real prize to a fox, and foxes take great numbers of them. On Isle Royale, where I studied mammals over a three-year period, I noticed that Snowshoe Hare numbers increased greatly during this time. I collected fox scats during each summer and found that Snowshoe remains composed the following increasing percentages of occurrence in the 295 scats: 17%, 46% and 52%. The foxes were eating a greater percentage of hares each year as the population increased, and in addition fox numbers appeared to increase each year.

Of course, the same phenomenon has long been known in the Arctic, where Snowshoe Hare numbers increase greatly during periods of about a decade, and then suddenly decrease. The number of lynxes also fluctuates in about the same way, evidently because the hare is the mainstay of the lynx. Just after the Snowshoe population crashes, so does the lynx population.

The population cycles of the Snowshoe Hare have been the subject of much controversy among biologists, and the question of their causes is not yet settled to everyone's satisfaction. However, Dr. John J. Christian has come up with the most cogent explanation that I have heard. He maintains that as hare populations increase, the amount of stress increases. This stress results from such things as crowding, increased rate of transmission of diseases and parasites and in-

creased fighting. The population takes about ten years to build to a crucial point of stress. Then the additional stress of an extra hard winter or of breeding overworks the stress glands — mainly the pituitary and the adrenal cortex and medulla. They are overtaxed and cannot help the animal adjust to its environment. The liver degenerates and loses its ability to store sugar, and the animal dies of hypoglycemic shock.

Great numbers of hares dead from shock have been found preceding the lows of the cycles, and



A Snowsoe Hare can make tremendous leaps and speeds of 25 miles an hour are reported.

Photo by the author



After a small radio transmitter was attached to its neck, this hare fed voraciously for a time and then wandered off and died, presumably because of the shock of capture and handling.

Photo by the author

it is generally conceded that Snowshoes are especially disposed to shock. Even when subjected to capture in a live-trap, many hares exhibit shock symptoms. I remember an animal I trapped and outfitted with a collar and tiny radio transmitter in order to study its movements. Immediately upon release, the creature began eating snow and twigs voraciously, oblivious of my presence. Soon it wandered off and died, about 100 feet away. Undoubtedly it died of shock, for overeating, lack of fear and sudden death are symptoms of that condition.

Not all trapped Snowshoes suffer from shock. Perhaps an individual's susceptibility is related to his general standing among other individuals in the area he uses. It is known that at least at times hares are hostile to each other. Several

Snowshoes often share the same general area, so there are plenty of chances for encounters. If Snowshoes are subject to the same rules of behavior as are other hares and rabbits, then there is an order of social dominance among them. An animal that is continually harassed by its neighbors might be especially subject to shock, whereas a more "secure" individual might not be so susceptible. Much research remains to be done here.

Although several hares simultaneously occupy the same general areas, each has its own system of "forms" used for resting during the day and during inclement weather. These slight hollows may be found in clumps of heavy vegetation, under blowdowns, in hollow logs, etc. One biologist kept watch on 46 forms over a two-month period and found that 62% of them were used at least twice during the period. He saw one hare in the same form 10 out of 11 successive times. This observer described the manner in which a Snowshoe assumes its resting attitude for the day: "When settling down to rest, the hare often rises upon its haunches and tucks its front feet well back under its rump, then lies with its chest and belly on the legs. This position is not unlike that of a hare at the beginning of a leap while running." Presumably this position allows the hare the best possible opportunity to spring out of the form and flee when disturbed. Speeds of Snowshoes have been reported as high as 25 mph.

Another adaptation for quick flight is the species' habit of using runways. Runways usually zig-zag through thick cover and form a network which certainly is an advantage to a hare with a predator in pursuit. Stuart Criddle, who made many significant observations of Snowshoe Hares (or Snowshoe Rabbits as they are sometimes called) told how the creatures maintain their runways: "Everything which might interfere with them when running is cut off close to the ground, the rabbits moving slowly forward as the work proceeds. Short stops are made every few minutes when the rabbit sits up, looks about and listens." In winter when they pack down the snow, "it appears as if they were hopping up and down in an aimless sort of way, yet a slight advance is made at each hop. The work done in this way by a single rabbit is so good that it looks as though it might have been done by a dozen rabbits."

In addition to these devices for quick escape, the Snowshoe also has a defense in its coat color, or at least that is the function generally attributed to its semi-annual change of color. In summer the Snowshoe's brown coat blends well with the dead leaves, logs and stumps in its environment. In winter its white fur makes it almost invisible in the snow. From a low-flying aircraft I have often seen Snowshoe Hares running over the white ground. Each was so hard to see that my tendency was to look behind it at the tracks appearing mysteriously in the snow! About the same time as the snow begins melting, the Snowshoe begins shedding, and as brown fur replaces the white, over an 80-day period, the mottled hare resembles the patches of snow in its surroundings. All this variation in coat color has given the Snowshoe the alias of "Varying Hare."

The name "Snowshoe Hare" alludes to the snowshoe-like hind feet of the animal. Its long, wide-spreading hind toes help it travel over deep, soft snow with ease. Thus the species extends much farther north than the Cottontail, with which it shares the southern part of its range. Snowshoes occur throughout most of Canada and Alaska, but in the contiguous United States they are limited to New England, the Appalachian

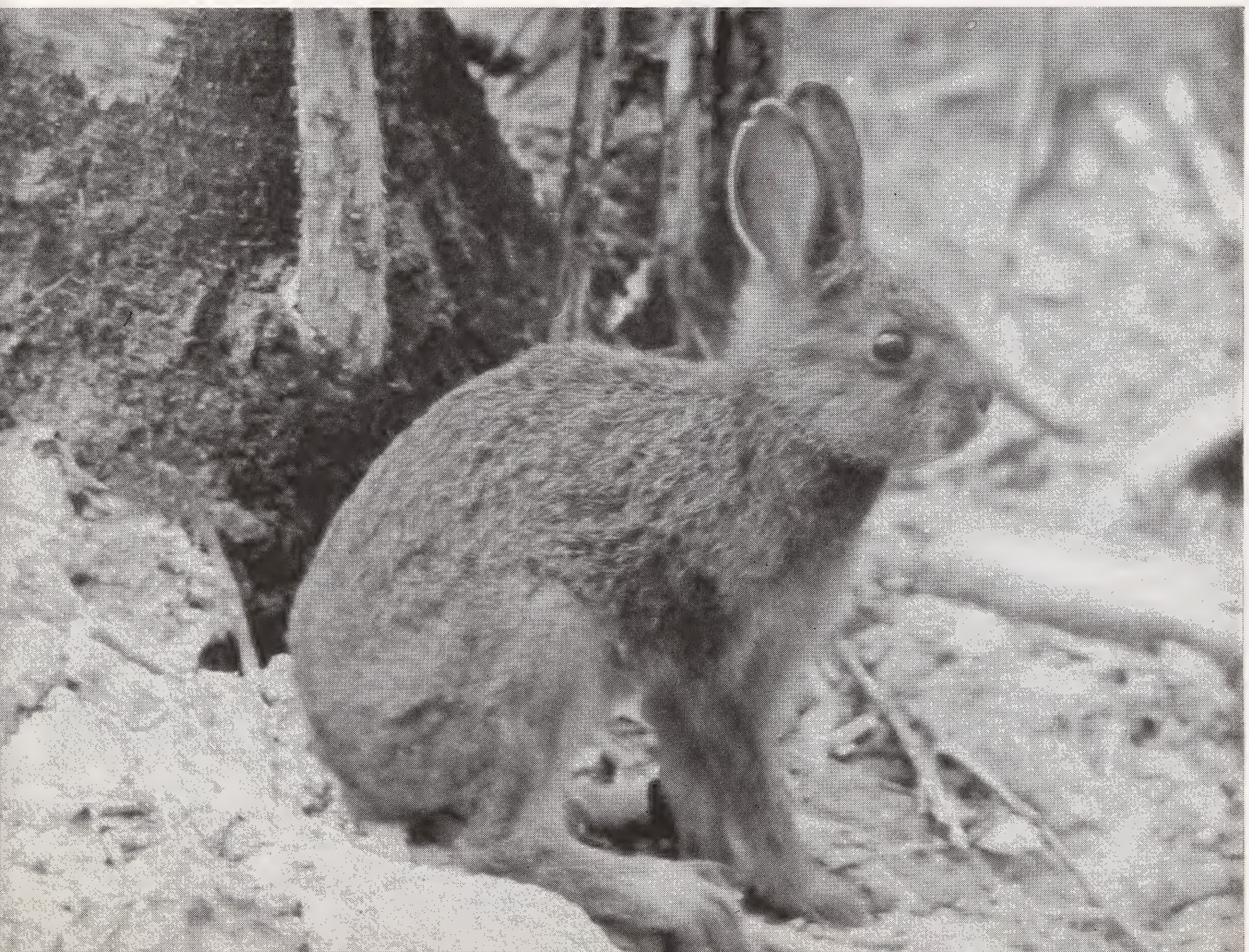
Mountains into Virginia, the northern or mountainous parts of New York, Michigan, Wisconsin and Minnesota; then across the country along the Canadian border, and southward in the western mountain ranges.

Within this range the Snowshoe prefers a mixture of hardwoods and conifers, whether on mountains or in thick swamps. Young stands of poplar, white birch, cherry and willow such as invade burned over areas also form excellent Snowshoe Hare cover, especially if interspersed with spruce, balsam or pine. Probably the most ideal habitat is the cedar swamp.

The type of cover occupied by a hare is one of the biggest determinants of the size of the animal's home range. One researcher reported that in sparse cover hares use an area with a radius of a mile or more. Another authority, who live-trapped and tagged a large number of Snowshoes, found that in good habitat adult males used areas about 25 acres in size, and females, about

The hare begins shedding its winter coat when the snow melts and over an 80-day period it is transformed into a brown animal blending into the summer landscape of dead leaves.

Fish & Wildlife Service Photo



19 acres. However, in several cases he captured an animal many times within an area of about 25 acres and then suddenly caught the same hare more than a quarter-mile away. Either these individuals shifted their ranges or had a much larger home range than the biologist originally thought. Another research worker trapped hares in Minnesota and hauled them off to an island more than a mile from the capture point. They had no trouble crossing an eighth of a mile of ice and returning to their original capture points.

The most extensive travels by Snowshoe Hares were reported by Stuart Criddle. He wrote concerning Snowshoes in Manitoba: "... we have often seen tracks which showed that they go back and forth across the three to five miles of prairie dividing our woods from those along the Assiniboine River. In November, 1933, I found the tracks of 17 rabbits which had crossed the large plain northwest of here in a wave. They had evidently traveled from 8 to 15 miles that night." This author also reported that there are two annual Snowshoe migrations in his area. One occurs from October to December and takes the hares from areas of light cover into heavy cover. The other long movement, occurring from February to April, was believed by Criddle to be associated with breeding.

Snowshoes begin breeding in March. Apparently Snowshoes perform some weird courtship rituals in which "drumming" — stamping the ground with the hind feet — plays an important part. Snowshoes are promiscuous, so there is much competition for each doe. One biologist told of nine hares that passed within a few feet of him during breeding season, "doing their rather queer looking kick hop, that is, kicking the ground resounding blows, at each rather high jump." Presumably these were eight males pursuing a female. After the female leads her attendant males on a merry chase, she suddenly allows one or more to mate with her.

Ten hours after mating, ovulation occurs, and young are born about 35 days later. The newborn hares — unlike the young of rabbits — are precocious. They weigh about 2.5 ounces and are fully furred; their eyes are open. The leverets can hop about when only a few hours old. They really don't have a nest, but their mother may keep them in an old log, under a stump or within

the shelter of a blowdown. There they nurse and grow stronger. Their weight doubles within eight days, and by the end of twelve days they are triple their birth weight. About this time they begin browsing on tender plants. By the age of one month the leverets are weaned, and weigh nine times their birth weight. They are two-thirds adult size at the age of three months and are fully grown at five months.

Snowshoes are not as prolific as their cousins, the Cottontail Rabbits. They bear two to three litters a year and average two to three young per litter, although litters of one to seven have been reported. Since young hares are much more able to care for themselves than are young rabbits, perhaps this is the reason that fewer offspring are born. Another reason might be because the mother is very protective. Female Snowshoes have been known to drum to distract enemies from their young. Stuart Criddle watched as a mother hare stamped the ground and led his dog away from her litter. The biologist also had a doe charge him while he was handling one of her screaming offspring.

Despite the lower reproductive rate, the species *Lepus americanus* survives just as well as its relatives. In fact, sometimes it survives too well — at least for human interests. During the peaks of Snowshoe population cycles, densities as high as 3,400 hares per square mile have been reported. Such a population can devastate the vegetation, and anyone owning a nursery near good Snowshoe cover at this time had better find a new business.

Although high populations of Snowshoes can be damaging to nurseries, plantations and orchards, the effects of high numbers of hares on the natural forest are only temporary and relatively unimportant. Just as Snowshoe Hare populations have withstood hundreds of centuries of predation, parasitism and disease, so too the forests have withstood the same duration of inroads by the hares and other woodland denizens. Since there still are vast expanses of good Snowshoe cover unspoiled by man, there is little reason to believe that the natural dynamics of the northern predator — Snowshoe Hare — boreal forest complex will be upset. It is gratifying to know that this interesting species is likely to be with us far into the future.

Zoo and Aquarium News in Pictures

Photographs by SAM DUNTON
Staff Photographer

A recent visitor to the Zoological Park was this Asiatic "Clawless" Otter, *Aonyx cinerea*, lent to us for study purposes by a private owner. "Kanoon" is about two years old and came from Thailand; the species is one of four in the Malaysian area. Despite its name, it has small, non-functional claws. There is relatively little webbing on the feet and the animal uses its hands somewhat more dexterously than other otters usually do.

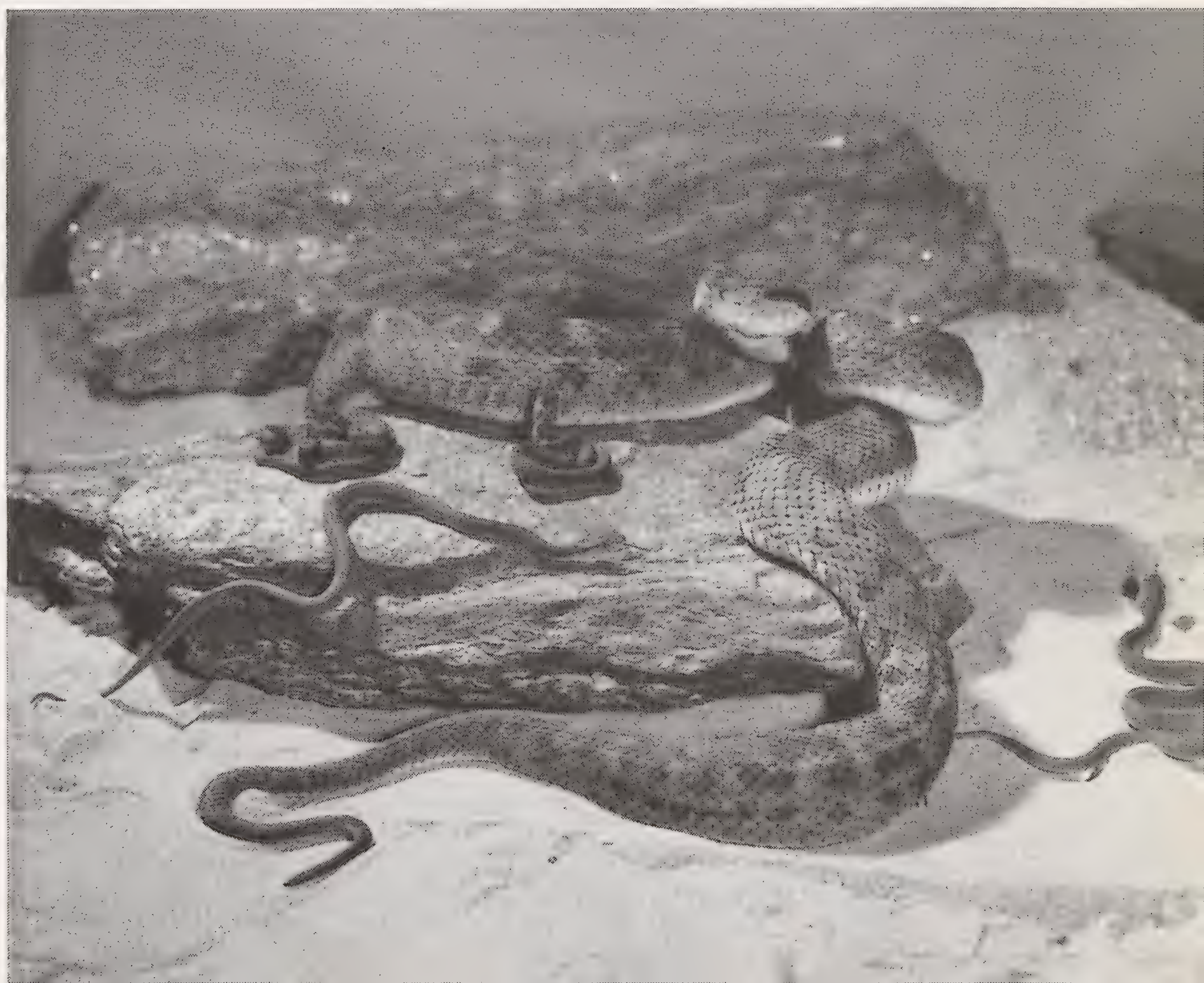


Fortunately the two White Whales at the Aquarium do not have to be moved very often — but we have a good technique for the operation when it must be done. In mid-October it was found that the Oceanic Tank needed repairs and that “Blanchon” and “Alex” would have to be moved to the near-by Tri-pool. The animals were immobilized on stretchers, a crane with a 100-foot boom lifted them one after another, and they were released unharmed in their new home. Blanchon was found to weigh 973 pounds and Alex 890 pounds.





of the services of our Education Department is Guided Tours of the Zoo school groups, such as this one being conducted by Herbert Knobloch, Associate Curator of Education. Comments on an elephant's use of its trunk on its teeth are likely to be remembered when they are accompanied by kind of demonstration. The elephants always cooperate on keeper command.



A St. Lucia Fer-de-Lance which Dr. Dowling collected in September paid dividends on October 5 by producing 34 young. All began feeding and are thriving. We are exhibiting five with the mother; some of the young will be sent to other institutions. Scientifically the reptile is known as *Bothrops caribbaea*. It is found only on the island of St. Lucia.

The Complete Aquarium Is on the Way

By PAUL MONTREUIL
Acting Director, New York Aquarium

WE ARE, AT LAST, on the threshold of our long-awaited emergence from the frankly inadequate "first phase" of the New York Aquarium into an institution worthy of our name and our history. Forced by circumstances to "make do" in a building which was neither designed to be operated as a *complete* aquarium, nor amenable to this purpose, the Aquarium staff has had ample time to ponder the attributes of completeness and to specify what we must have.

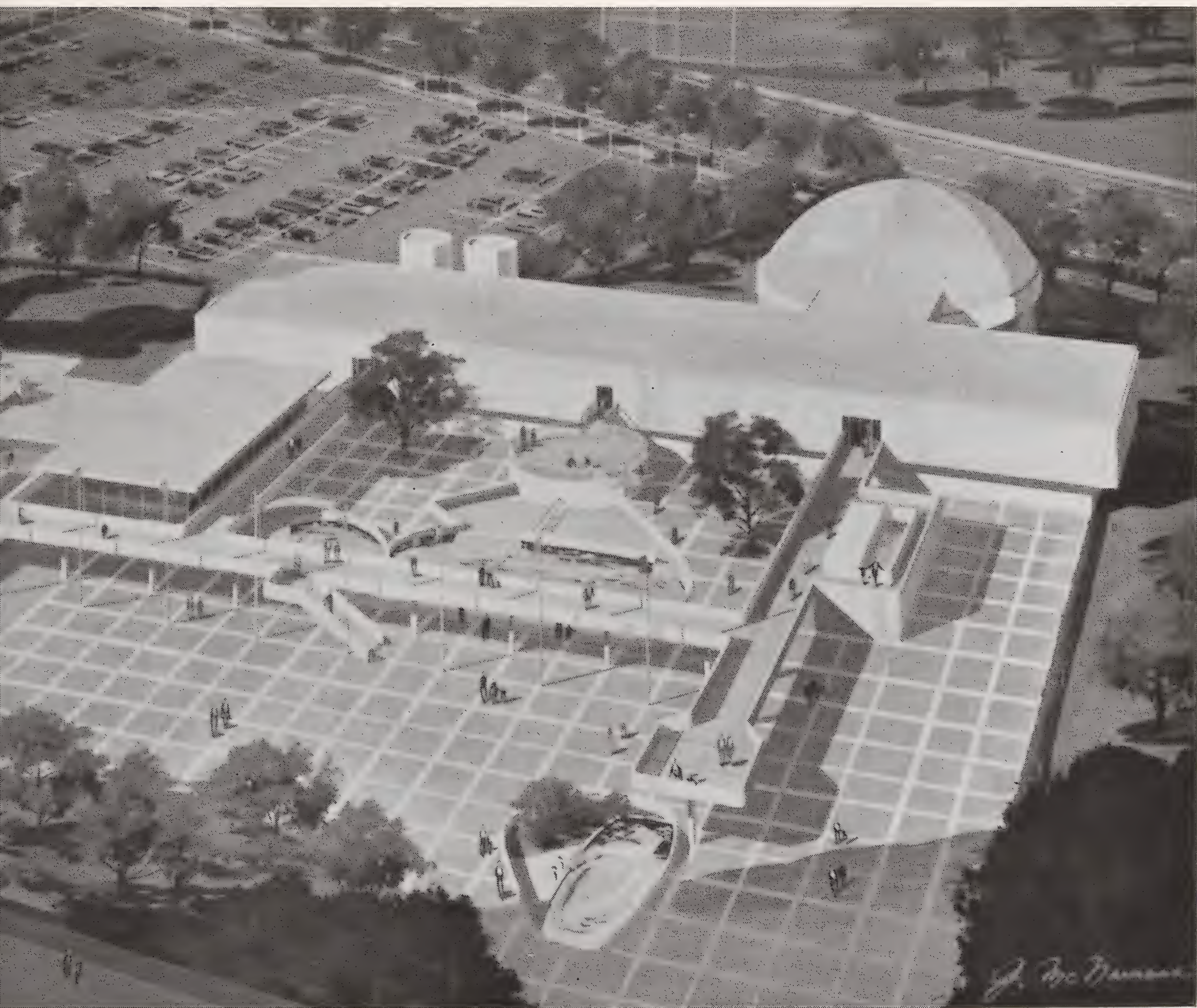
It is to the credit of the engineering firm of Thomas Riddick & Associates and of the architect, Bruce Campbell Graham, that they have succeeded so completely in incorporating the features we consider essential to the development of the Aquarium into a significant presentation of the water life of the world. Not the least of their accomplishment is joining the existing perman-



ent displays and the new ones in a well-integrated, meaningful whole.

Plans for the great Osborn Laboratories of Marine Sciences have already been announced, in the July-August issue of *Animal Kingdom*; the architect's sketch shows how those laboratories fit into the new, over-all plan. The notes that follow are concerned with the expansion of the Aquarium proper, on which we expect work to start in the coming year.

Our new design incorporates many striking features, several of which will contribute to make it one of the most spectacular aquatic exhibits anywhere. "Shark Hall," as we refer to it at this stage, takes its name from the principal exhibit — the "Shark Drome." This is no conventional display with people looking at fish in a tank, for here the visitors will be on the inside looking out and surrounded by large sharks. The



visitors, in effect, will be submerged in the center of a gigantic doughnut-shaped body of water. Sharks need space and uninterrupted headway; they do best in a continuous trough where a slight current can be set up. Corners are anathema to these powerful swimmers who cannot suffer the frustration of walls and obstacles. A doughnut-shaped trough is the ideal form of tank for these animals, and this is a big one: 80 feet in outside diameter, with a 40-foot hole in the center. It will hold roughly 150,000 gallons.

Instead of viewing from the top and the outside, visitors will be *under* and *inside*. The inside wall will be a clear, unbroken expanse of glass or transparent plastic surrounding the raised, circular public platform, 30 feet in diameter, which will be reached from the main hall by descent through the corridors, under the ring of the Drome.

An over-all view of the Aquarium as it is now developing. The "Shark Drome" is the big circular structure on the north side of the new L-shaped addition to the existing installation.

Bruce Campbell Graham, Architect

Without doubt, this will be one of the most talked-about aquarium exhibits anywhere. The characteristics of the tank make it possible to hold sharks of greater size than any kept up to now and to show them off to the best possible advantage — indeed, as if we were under water with them ourselves.

If the "Shark Drome" tends to overshadow other features, this is illusory and relative. A very large section of the new plan calls for an L-shaped building, the leg of which will be an amphitheatre-like area surrounding a greatly-expanded electric fish exhibit. Here a dozen or

so tanks will provide continuous demonstration of bio-electro-genesis as well as the more familiar scheduled electric eel displays. Another portion of the leg of the L will be available for flexible, movable exhibits of a temporary nature, developed topically and in tune with, for example, seasonal interests.

The main portion of the building, the body of the L, will accommodate aquatic communities ranging in size from a gigantic reef tank of 20,000 gallons capacity, almost 40 feet long, to more modest 7-, 10-, and 12-foot tanks of 700 to 1,000 gallons, and on down to small "jewel"

A cut-away view of the "Shark Drome" in which visitors stand in the "hole in the doughnut" for an unobstructed view of sharks swimming.

Bruce Campbell Graham, Architect

Construction will soon start on the Osborn Laboratories of Marine Sciences, adjoining the present Aquarium building near the entrance at the west end.

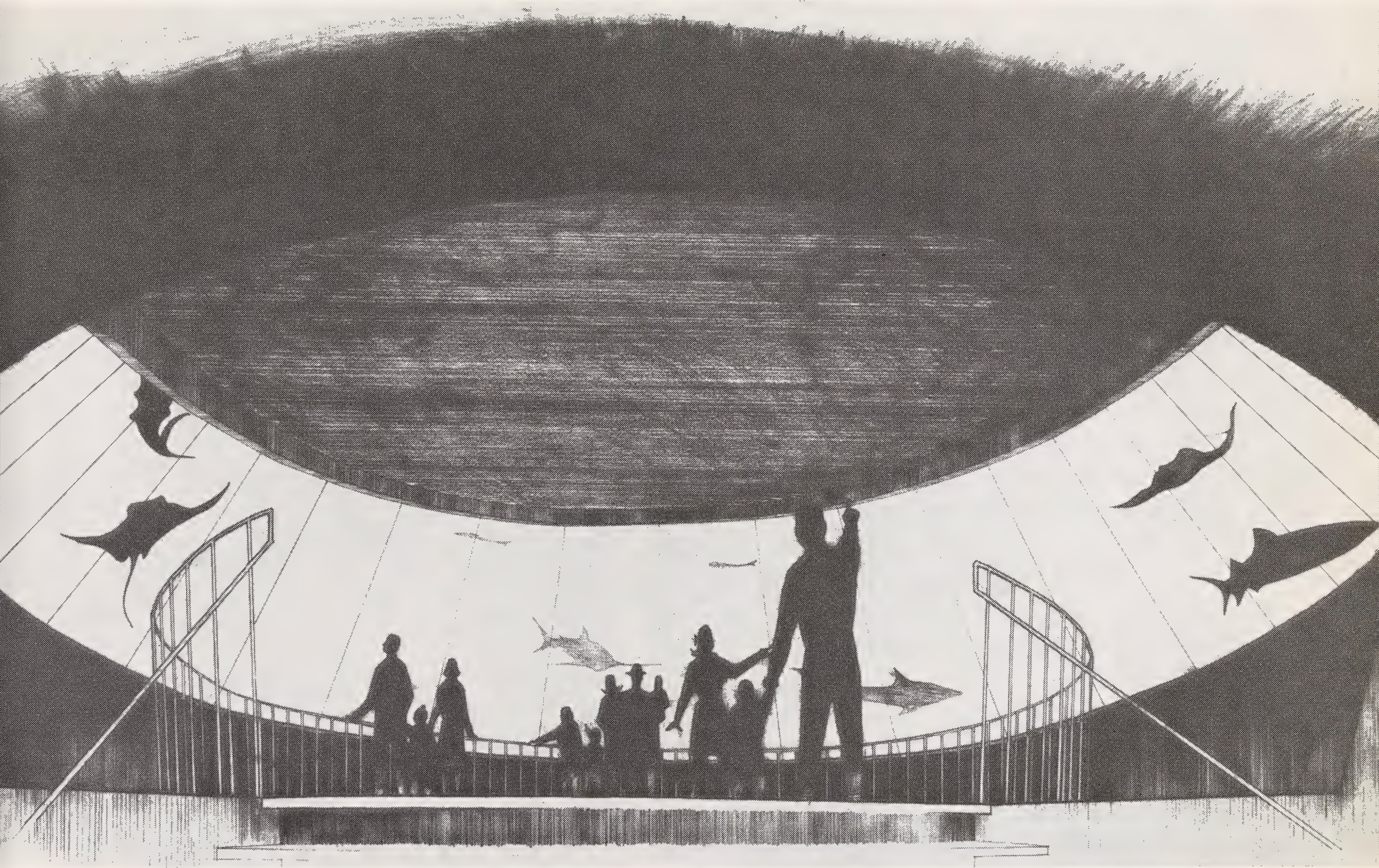
Goldstone & Dearborn, Architects



aquariums. All told, the exhibit area in this portion alone (not including the "Shark Drome" nor the electric fish displays nor the topical area), will be more than four times our present permanent viewing area. Since it pays close attention to the development of a logical and orderly traffic pattern, the entire layout is designed to foster a feeling of suspense as the visitor proceeds through the maze-like corridors from one viewing point to the next. Climactic displays are inter-

spersed among more conventional ones in such a way as to build up to the climax of the "Shark Drome," and then smoothly lead on to the continuation of the tour past the ever-popular schooling fishes, the walruses, seals, and the like.

The "behind-the-scenes" view of aquarium operations is always fascinating and we have incorporated it. An elevated ramp connecting all outdoors exhibits and the restaurant will lead to a viewing area overlooking some of the me-



chanical equipment — control instruments, laboratory, reserve tanks and other essential adjuncts of a large aquarium.

Our expanded New York Aquarium will have a minimum of pumps, those banes of aquarists and a major source of trouble. Most of the water-moving will be done by means of air lifts and gravity — the simplest of all possible means. This is a radical departure from usual practice, but the essence of logic itself will be to place the service areas above the display level. A modern and well-designed food preparation area will serve as a “kitchen” for the entire Aquarium. Adjoining it will be freezer and cold-storage facilities. A laboratory is planned for routine, essential control and analytical studies of water condition. This latter, of course, is quite apart from the research functions of the Osborn Laboratories of Marine Sciences which adjoin the present building on the north.

The largest tanks will open directly through the floor into the service level, and all will be operated with integral biological filters such as

we have recently put on trial in our present Shark Tank. This latter will eventually become a display of pelagic fishes, a group that is readily available, easily collected and — as we know from experience — perennially popular.

Two tall cylindrical towers will be noticed in the architect’s drawing. These are storage tanks for 60,000 gallons of water each — water that has been previously treated in an independent aeration, filtration, heating and conditioning plant after being brought up from our deep seawater wells. These tanks can be drawn upon at will to obtain water of any desired temperature. All display and reserve units will be operable either as open or closed systems, or combined so as to provide a maximum of flexibility and efficiency. They should give us a minimum of uncontrollable factors which are likely to lead to disease and epidemics.

So here we have it at last — bold, imaginative, spectacular, workable new designs for one of the finest aquariums in the world today. We are on the way.

Zoologist's Tour of Martinique

By **HERNDON G. DOWLING**

Curator of Reptiles

NINETEEN hundred and fifty miles south-southeast of New York lies the French island of Martinique. It is well within the tropics and is situated at about the middle of that 700-mile crescent between Puerto Rico and South America that is called the Lesser Antilles. A mountainous island, forty miles long and up to twenty miles in width, it is one of the largest of this island group.

The name "Martinique" means different things to different people. To the geologist and historian it is the site of that great tragedy of 1902 when a suddenly-activated Mount Pelée discharged its poisonous volcanic gases onto the sleeping town of Saint Pierre, killing more than 30,000 inhabitants. To the romanticist-historian it is the birthplace of Napoleon's Empress Josephine, while to modern tourist agents it is "a star in the heart of the Caribbean," "the Pearl of the Antilles," a place to lure the winter-weary Yankee in January.

The zoologist and conservationist is interested in the island for somewhat different reasons. He is interested in the island's original fauna, what changes have been brought about by the activities of man and, most important, what its prospects are in the future. These questions are pertinent to any land area, of course, but they are particularly critical on a small island where a "slight" change in land-use may upset the entire animal community.

Martinique, along with the other Lesser Antilles, has apparently never been connected with the American mainland, and is thus an "oceanic" island by geologic and zoogeographic definitions. Such oceanic islands usually have a small fauna in terms of number of species but these are of



great interest, ordinarily, because of their unique nature ("endemic species") or because they give information about the past history of the island through their various relationships. Although Martinique is some 250 miles from the mainland, a series of other islands scattered from it to the northern coast of South America has acted as "stepping-stones," bringing some mainland species to the island. Further, Martinique is within sight of its neighboring islands, Dominica to the north and Saint Lucia to the south, and is separated from them by water gaps of only 30 to 40 miles. This could lead to some migration of at least winged forms such as insects and birds.

Martinique does share a considerable portion of its fauna with adjacent islands. Many of the

larger and stronger-flying birds are found throughout the Caribbean region. Other tough arboreal animals that are apt to be blown in treetop rafts for considerable distances are also shared with other islands. Thus, the common tropical opossum (*Didelphys marsupialis*) is (or was) found on Martinique as well as islands to the south. The West Indian Iguana (*Iguana delicatissima*) is shared with islands to the north, as is the thrasher-like bird called the Trembler (*Cinclocerthia*, a genus found only in the West Indies). The White-breasted Thrasher (*Ramphocinclus*, another endemic genus) is shared with Saint Lucia. Both of the latter birds had recognizably-distinct populations on Martinique, however, and it was not so long ago that the island was the homeland of a unique species of the beautiful West Indian parrots (*Amazona*). It had "become extinct" some time ago, according to report.

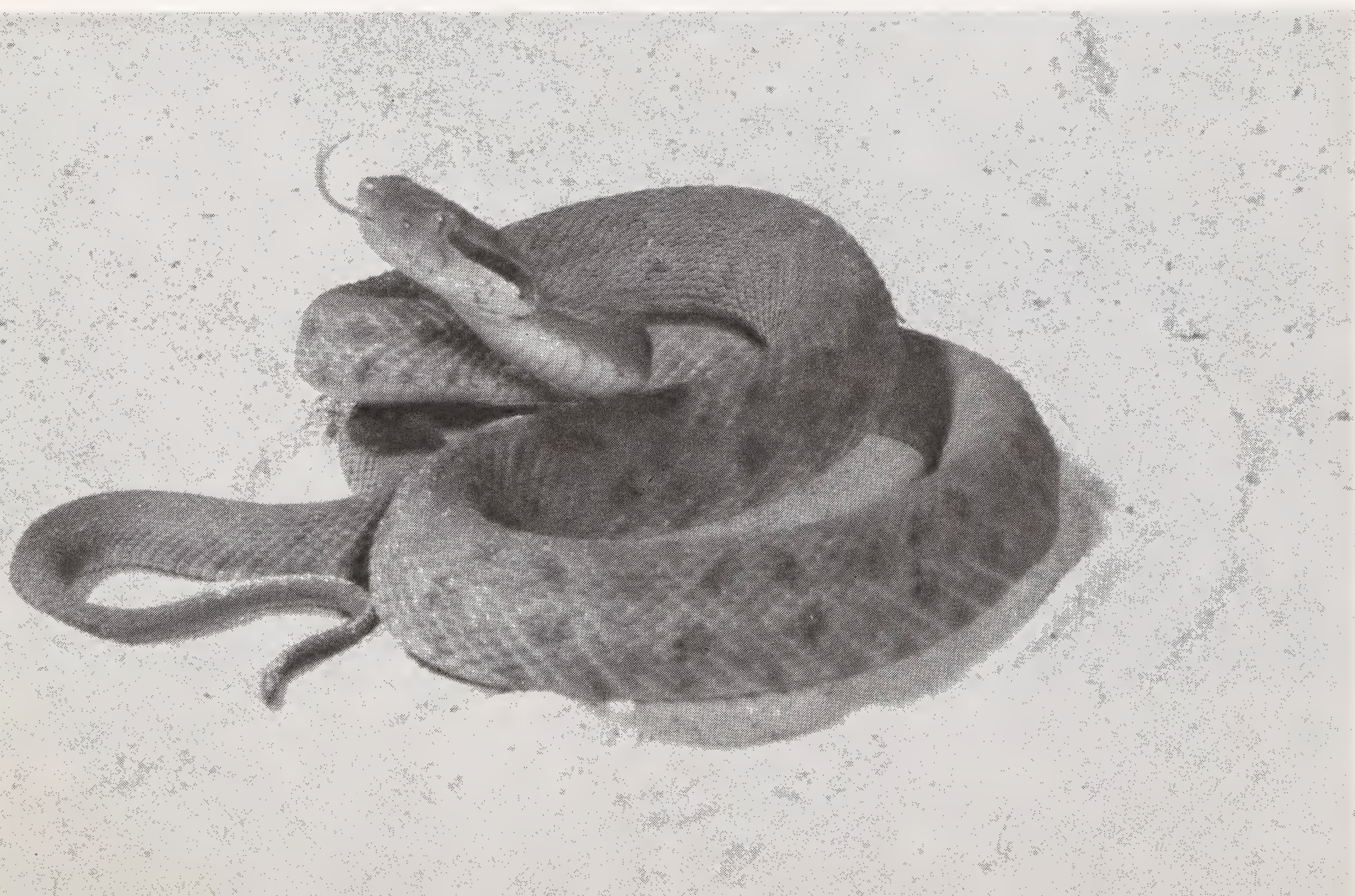
My major interest on the island was none of these. The Martinique Fer-de-Lance, so famed since the seventeenth century as to appear on the official seal and flag of the country, was the real object of my search this past summer. It had been reported and re-reported for more than 300 years, yet its present status and its relationships

The Martinique Fer-de-Lance, *Bothrops lanceolatus*, differs in scale-count, coloration and potency of venom from the more familiar *Bothrops atrox* of Trinidad and the mainland.

were still in question. I spent eight days crisscrossing the island, looking under bridges and behind rocks in the daytime and along roads and streams at night. I did not find any Fer-de-Lances while doing this (the lone individual I brought back was captured by a friendly Martiniquan) but I saw a lot of the country.

One of the most impressive features of the island was the over-all apparent *absence* of native animal life. The native mammals, the opossum and a unique rat (with the rather difficult name of *Moschophoromys desmaresti*), would have been inconspicuous in any case, but where were the birds? In an hour's walk on Antigua (180 miles to the north and farther from the mainland) I had seen Cattle Egrets, Bananaquits, Grassquits, one or two kinds of doves, two kinds of hummingbirds, a flycatcher and some kind of sandpiper — all in some numbers. Here on Martinique no large birds were visible at all. Even a Bananaquit was a rarity and the hummingbirds seemed few and shy.

I knew that the weasel-like Indian Mongoose had been introduced on the island in about 1845 to "control" the Fer-de-Lance. Such introductions had caused the decline and disappearance of some ground-nesting birds on other islands, but most of those I expected to see were not ground-nesting. Further, the mongooses on Antigua and nearby Saint Lucia did not appear to have decimated the bird life to the extent seen on Martinique.



After a few days of travel I began to suspect the real agent of their disappearance. Mornings and evenings, along the roadside brush and hedgerows small boys could be seen searching the trees and bushes. Armed with small-bore rifles, alone or in groups of three to five, the boys were scouring the countryside for any bird, no matter how small, that might be added to the dinner pot.

The only bird even relatively common was the Antillean Grackle. This ubiquitous bird could be seen in the towns as well as in the countryside. My conclusion was that the grackle must be highly prolific, inedible, or some combination thereof, to have survived in such numbers.

The unique Amazon Parrot of Martinique had become extinct many years ago — apparently from (to borrow a phrase from Marston Bates) the “prevalence of people.” However, some of the other endemic birds were said to still survive and I made some effort to visit the places where they had been last reported.

Père Pinchon, of Fort-de-France, the capital city, had reported to the *International Union for the Conservation of Nature* (IUCN) that the Martinique Trembler was restricted to the environs of Trois Ilets, just across the bay from Fort-de-France. If it still occurs there (I did not

see any), its days must be numbered. Most of the flat land in the vicinity is now in pasture or is planted in sugarcane. The hills are badly cut over and some of them, too, are planted in cane — and wherever you look are *people*. Shacks and houses are not confined to villages and towns, but are scattered over the countryside to the tops of the highest hills. While a thrasher-like bird like the Trembler might find sufficient forage along the hedgerows to survive *if protected*, it would appear to have no chance under present conditions.

The Martinique White-breasted Thrasher was said to be found, still, on the long eastern peninsula known as “Presqu’île de la Caravelle.” The peninsula has, as yet, only a single small fishing village on it and would appear to be an ideal situation for a wildlife reserve area. Some of the original forest still survives on the peninsula but it is badly cut over in most places. Some of the more gently-rolling land is planted in cane but the hills and coasts are relatively unused except for timbering.

The bird known as the Trembler is supposed to be restricted to the environs of Trois Islets but, as this view of the area shows, there is heavy cultivation and almost no cover for it.

Photo by the author





Except for the *chek-chek* scolding of some dimly-seen long-tailed birds in the coastal forest, I saw nothing of the White-breasted Thrasher. However, its habitat is much less disturbed and its locality less peopled than that of the Trembler.

The mountains in the northern part of Martinique are extremely steep and range into the thousands of feet in height. This rugged terrain has restricted the human population much more to river valleys and coastal areas, thus allowing tree ferns and bits of original forest to survive along the mountainsides. It is this region that is still, according to local report, heavily populated with the much-feared Fer-de-Lance, where the Antillean Iguana still survives, and where other elements of the natural environment might find refuge. Even here, however, the native wildlife seemed virtually gone. The absence of bird calls made the forests unusually still and the jewel-like *Anolis* lizards were the only signs of animal life.

The southern slope of Mount Pelée, which rises to about 4,500 feet, even has an area that is marked "Refuge" on one map. We know that the life of that region was exterminated by the eruption of Mount Pelée in 1902, however. Whether the "Refuge" has some validity (it certainly does not for the birds that are known to

On the northern part of Martinique people are relatively fewer and some vegetation remains. Dr. Dowling traversed this area and found no reptiles except a few lizards and some frogs.

Photo by the author

be threatened with imminent extinction) or whether the area is just not valuable for any other purpose is not known to me. Certainly the apparently callous disregard for the "public good" exemplified by Fort-de-France's dumping of trash on the public beach leads to some skepticism of the "Reserve."

Perhaps it is to be expected that an island that was settled as long ago as 1635, an island that affords space for 290,000 persons within its 385 square miles, would have a much-used look. Certainly most overseas colonies have been exploited by their foreign owners and by their inhabitants. It seems a shame, though, in these "enlightened" times, to see so little in the way of wildlife conservation being practiced in a land that is considered a *departement* of one of the most civilized countries on earth — France. Perhaps such practices are under way, but so far, at least, the misuse of the land is by far the most visible aspect of the "Pearl of the Antilles."

News from the Conservation Foundation

Study Group in Human Conservation

Dr. William Vogt is currently engaged in planning a resource study conference to be held in Guatemala City September 21-25, 1965, at the Instituto de Nutricion de Centroamerica y Panama. Participants will endeavor to define the major conservation problems and related social, technological, economic, and political conditions in Central America. Members of the steering committee are Lic. Mariano Ramírez Arias of the University of Costa Rica, Dr. Gerardo Budowski of the Interamerican Institute of Agricultural Sciences, Dr. Moisés Béhar of the host institution, Dr. Gabriel Dengo of the Secretaría Permanente del Tratado General de Integración Económica Centroamericana, and Dr. Manuel Noriega Morales of the Central American Institute of Industrial Research and Technology.

The conference will be preceded by a two-day field trip to areas already treated and those needing conservation attention in El Salvador. Papers submitted for discussion during the conference are expected to describe the present state of resource knowledge in Central America and the necessity for further research. Such topics as economics, sociology, nutrition, education, water use, land-use capabilities, energy resources, man in the ecosystem and laws and legal problems will be discussed.

It is hoped that this conference will produce specific and practicable recommendations for action on the part of governments, foundations, universities and other groups. Some of these will be presented in the form of an "Atlas of Ignorance," mapping further research needs and printed in both Spanish and English.

Biological Survey in Alaska

The first major biological reconnaissance of the Baird and Schwatka Mountains has just been completed under the direction of Dr. Frederick Dean of the University of Alaska. The primary purposes of the study were to relate the flora and fauna of the region to an ecological framework,

to obtain taxonomic specimens of bird, mammal, and plant species for deposit in museums and to make a preliminary comparison of the grizzly bear in the region with the same species in the Alaska Range.

Briefly Noted

The first meeting of the Board of Governors of the Pinchot Institute for Conservation Studies was held on Thursday, November 12, at the University Club. Members of the Board are Laurance Rockefeller, David M. Heyman, Dr. E. DeAlton Partridge, Dr. George Selke, Joseph L. Fisher, Dr. Samuel T. Dana, Dr. Wilson Clark, Dr. Gifford Pinchot, Fairfield Osborn, Samuel H. Ordway and Edward P. Cliff. . . . Dr. F. Fraser Darling will present an introductory paper for discussion at a conference in Bonn during December. He will speak on the needs of the developing countries in regard to education, training and research. Co-sponsored by the German government and F.A.O. and organized by the German Foundation for Developing Countries, the general theme of the conference is Wildlife Management and Utilization. . . . John Milton attended the annual meetings in October of the Natural Resources Council and the American Forestry Association in Asheville, North Carolina. In November Mr. Milton represented the Foundation at the Conference on State Natural Area Systems at the University of Wisconsin in Madison. . . . Martha Munzer is currently conducting a series of lectures for the Ethical Culture Society on "The City and Suburbs: Problems in Conservation." Alfred A. Knopf has just published Mrs. Munzer's latest book for young people on city planning, "Our Town — Today and Tomorrow." . . . The Third Edition of "A Critical Index of Films and Filmstrips in Conservation" is now being prepared for printing and distribution. To date some 10,000 teachers and leaders of conservation organizations throughout the United States and in Canada are using the first two editions of 1960 and 1961.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

Expedition in Antarctica for Weddell Seal Work

Boxes of motion picture film shot under the ice of Antarctica have begun to arrive from the Zoological Society's second expedition to investigate the Weddell Seal, *Leptonychotes weddelli*. The studies are being made under a grant from the National Science Foundation and will cover underwater echo-location, parasitology, enzymology and thermoregulation in this most southerly of mammals, as well as — it is hoped — complete last year's work on the microbiology of the animal.

Principal Investigators for the study are Acting Director Paul L. Montreuil and Associate Curator Carleton Ray of the Aquarium. Dr. Ray left for Antarctica on October 11, accompanied by Lt. David O. Lavallee, who was a member of last year's team, and Peter R. Gimbel, a Trustee of the Zoological Society. They were to be joined later by Jacob Hiller, a technician, and in acoustical work they will cooperate with William A. Watkins and William E. Schevill of the Woods Hole Oceanographic Institution.

The investigations will be completed about mid-December and in late February there may be an opportunity to return for live specimens.

"Bugged" Burrow Reveals Fiddler Crab Secret

Fiddler Crabs are known to make a variety of sounds, but to the zoologist studying them the big problem is hearing and recording the signals. Director Jocelyn Crane of the William Beebe Tropical Research Station in Trinidad, in her latest report on the station's activities, was able to announce success by a surprisingly simple device.

"In testing a portable tape recorder on East Asian fiddlers last year, all the local noises — from firecrackers to jets — were more readily audible than any possible performance by the crabs," she wrote. "Here in Trinidad, traffic sounds were an

equal trial, since the only convenient swamps were close to highways.

"Now Physicist Michael Flinn has solved the difficulty with a bargain gadget an inch across. It is a small hearing-aid for human beings, the kind that conducts through bone. It has proved to be just right, both for ignoring the traffic and for picking up the thumps, clicks, glucks and blubs that crabs make in their burrows.

"Early in the summer we tested a *rapax* in the laboratory, but he made never a sound. Then we made a last try out on a mudflat. We set up the recorder, put on earphones and pushed the hearing-aid into the mud alongside a *rapax* burrow. As usual we dropped an intruding crab into the burrow, hoping to elicit an audible warning. But I soon complained to Mick Flinn that his gadget wasn't working right — traffic noises were coming through, especially a bothersome horn.

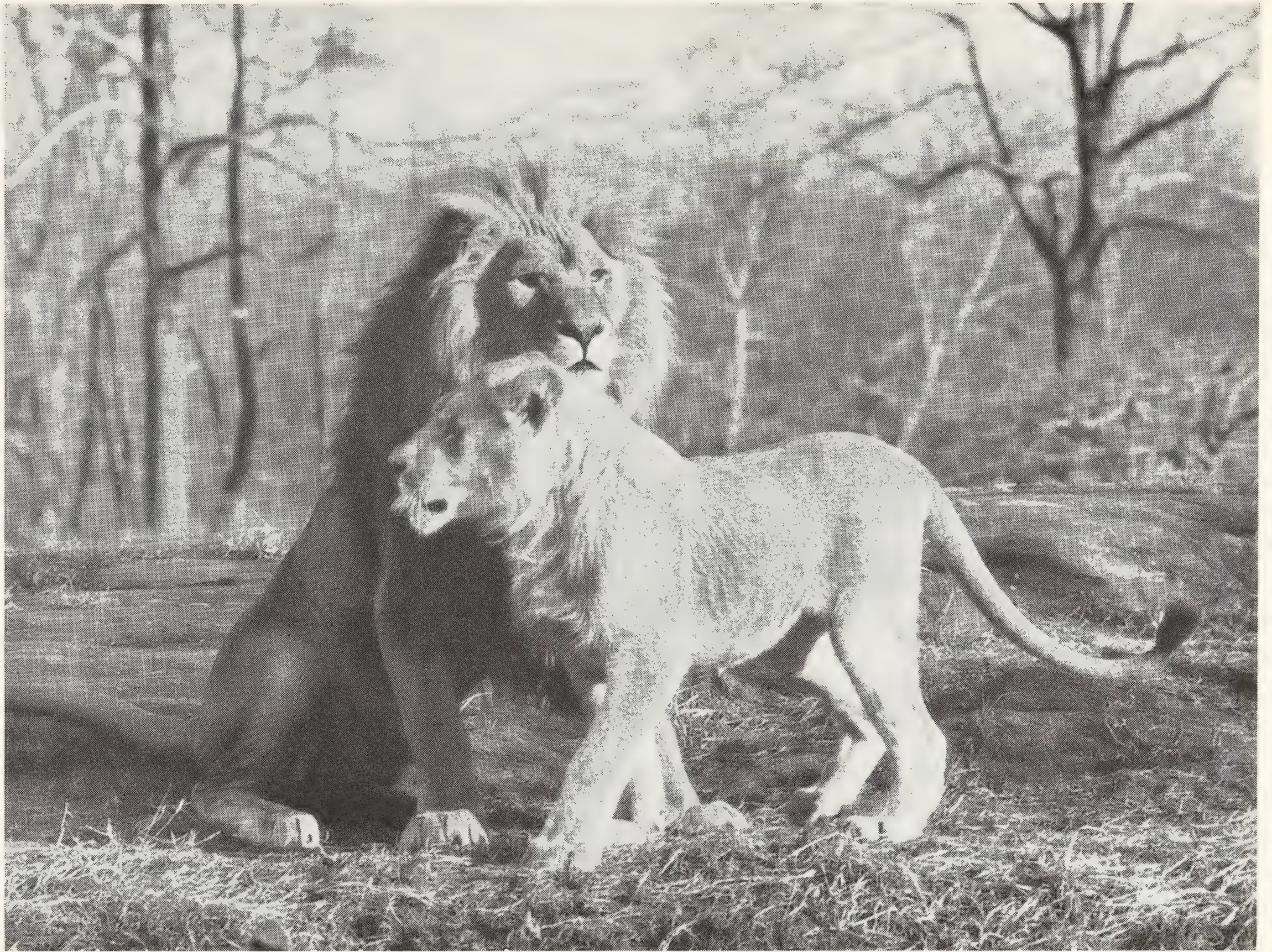
"Mick didn't agree. He shrugged, pointed down the burrow, gestured with thumbs up. So I listened again. The same sound came through. 'Honk,' it said. And again 'Honk! HONK! HONK!' This was no horn on the highway, but a protesting *rapax* defending his burrow with verve.

"As the intruding crab scrambled out and we gathered up our gear, I felt as startled as a western parent whose child speaks first in a burst of Chinese!"

Christmas Week Party at Zoo for Channel 13 Children

For the first time, and as an experiment, the Zoological Park will put on a party in the Lion House during the week between Christmas and New Year's for children of subscribing members of Channel 13, the educational television station in New York.

After a showing of some of the Zoological Society's animal motion pictures, keepers will demonstrate the accomplishments of their animals —



Extraordinarily protracted Indian Summer weather has permitted several out-of-doors exhibits to continue on a summer basis until late November. The Lion Island family was out daily.

a giant snake from the Reptile Department, monkeys from the Mammal Department and various birds that can be handled. The climax of the party will be the feeding of the big cats — a noisy and lively time.

The party will be announced over Channel 13 in the holiday season and will be limited to children whose parents are subscribers to the educational station.

A Plane for Uganda National Parks

Control of poaching, game counts and observations of game migration are serious problems in the Uganda National Parks. Similar problems in the National Parks of Tanganyika and Kenya have been met effectively by light airplanes provided by the Zoological Society through its African Wildlife Fund, and we have now made a contribution to Uganda for the purchase of an airplane.

IN BRIEF

Honors and Jobs. Director Conway has been elected Secretary of the American Association of Zoological Parks and Aquariums. . . . Reptile Curator Dowling has been appointed Adjunct Professor of Zoology of Rhode Island University. . . . Staff Photographer Dunton has been reappointed to the Board of Examiners of the Biological Photographic Association. . . . Personnel Manager McKew has been made editor of the *New York Personnel Manager Association Bulletin*.

Mr. Crandall's Book. Although it was published only last July, "The Management of Wild Mammals in Captivity" by General Curator Emeritus Lee S. Crandall seems likely to go into a second printing soon. The University of Chicago Press reports that the American portion of the first printing has been sold out and that more

copies are being imported from England — where it was printed — to meet the continuing demand in this country.

PUBLICATIONS OF INTEREST

WATERFOWL TOMORROW. Edited by Joseph P. Linduska and Arnold L. Nelson. With a foreword by Stewart L. Udall. Illus. in black and white by photographs and numerous drawings by Bob Hines. 770 pp. Pub. by the U.S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Washington, 1964. \$4.00.

In a combined effort, 103 experts in wildlife management and related fields, have covered thoroughly the present status and future prospects of the 48 species of swans, geese and ducks found in North America, including Canada, the United States and Mexico. In a foreword, Dr. Linduska frankly states his hope that this exhaustive exposition will be helpful to the governments concerned in the formation of future policies. For the general theme is conservation and few of the dangers that threaten our native waterfowl and few of the means for shielding them have been overlooked. The detailed accounts have been given by men thoroughly familiar with their local areas and will be of the greatest service in the formulation of protective measures. — L.S.C.

THE WORLD OF BIRDS. By James Fisher and Roger Tory Peterson. Many illustrations in color and in black-and-white, from paintings and photographs. 288 pp. Doubleday & Co., Inc., Garden City, 1964. \$17.95 pre-Christmas, then \$22.95.

Unlike the usual “bird book,” this handsome volume is basically devoted to an exposition of the lives of birds and their relationship to man, although the more technical aspects are by no means overlooked.

Early chapters are devoted to general physical aspects, including adaptations, flight, colors and comparative size. Extinct birds, evolution, species development, migration and reproduction are discussed at length. Detailed instruction for the enjoyment of bird watching are given. Then come 96 pages devoted to classification, complete with silhouette drawings of representative members of most Families and colored maps showing distribution. The final chapter, “Birds and Men,” covers almost every conceivable aspect of this relationship, including aviculture and zoos. Lists of threatened species and those that have become extinct since 1600 are appended.

If it were written in technical style, this immense assemblage of information might have been formidable indeed, but the general tone is so warm, so enthusiastic, that technicalities slip by unnoticed. Points are emphasized throughout by Roger Peterson’s superb paintings (one enthusiastic counter reports 668) and James Fisher is a master of down-to-earth writing. Together they have made a beautiful and informative book that leaves few ornithological fields untouched. — L.S.C.

SONG AND GARDEN BIRDS OF NORTH AMERICA. Alexander Wetmore, chief author and consultant. 400 pp., 555 illustrations, 509 in color. National Geographic Society, Washington, D. C., 1964. \$11.95.

An imposing array of ornithologists and photographers and artists combined to produce this magnificently printed home reference book on 327 species of our native birds. The bird biographies are brief — mostly half a page or less — but they are to the point, and the groups are preceded by more extended articles

by experts every ornithologist would recognize. An album of six bird-song records is pocketed in the book.

WILD LIVES OF AFRICA. By Juliette Huxley. Introduction and postscript by Julian Huxley. 255 pp., 65 photographs; maps. Harper & Row, New York, 1964. \$5.95.

Impressions, descriptions and often penetrating observations of animals, scenery and people, gathered on a journey in 1960 through South, East and Central Africa.

LIFE IN THE SEA. Photography by Lennart Nilsson, text by Gösta Jägersten. 184 pp. Profusely illustrated, mostly black-and-white. Basic Books, New York, 1964. \$10.00.

Photographs, with brief but generally explanatory text, of the smaller forms of life in the sea. Most of the photographs were made at Uppsala University’s biological station at Klubban on the west coast of Sweden.

THE LAND AND THE WILDLIFE OF AFRICA. By Archie Carr and the Editors of *Life*. 200 pp., profusely illustrated in color and black-and-white. Life Nature Library. Time, Inc., New York, 1964. \$3.95.

The concept of the biological community, of the interaction of plants and animals (and, increasingly, of people) is never very far below the surface in Dr. Carr’s free-flowing, typically lucid survey of Africa. He is as up-to-date as the I.U.C.N. Nairobi conference of 1963 and as readable as only Archie Carr can be. The pictures are worthy of the text.

THOREAU ON BIRDS. Compiled and with a commentary by Helen Cruickshank. 331 pp., black-and-white illustrations from Nuttall, Wilson and Audubon. McGraw-Hill Book Co., New York, 1964. \$7.95.

References to birds, almost always significantly observed, abound in Thoreau’s writings but how many there are would hardly be realized except for such a gathering as this. Helen Cruickshank’s pertinent comments are a nice frame for the pure Thoreau and make this a delightful book for dipping into.

CATS OF THE WORLD. By Armand Denis. 144 pp., 87 photographs and drawings, in color and black-and-white. World Wildlife Series I. Houghton Mifflin Co., Boston, 1964. \$5.95.

Despite the fact that sizeable books have been written about some of the 35 wild cats of the world — Guggisberg on the Lion, for instance — it is still necessary to say about many of the smaller cats that “comparatively little is known” about their lives in the wild. Mr. Denis has collected photographs, searched the literature, and produced a readable account without making many new contributions to our knowledge.

THE WILD LIFE OF INDIA. By E. P. Gee. Foreword by Jawaharlal Nehru. 192 pp., 112 photographs in color and black-and-white. E. P. Dutton & Co., New York, 1964. \$5.95.

Say “India” to a naturalist and “E. P. Gee” comes to mind, for since he went out to India in 1927 he has photographed and written much about the fascinating wildlife of that land. Now he recounts his experiences in a lively book, illustrated by his own masterly photographs. One of them, incidentally, is of the Takin now in the Bronx Zoo.

BIRDS OVER AMERICA. By Roger Tory Peterson. 342 pp., 105 photographs. Dodd, Mead & Co., New York, 1964. \$7.50.

A new and revised edition of a 1948 classic of personal experiences with birds by the ornithologist-artist to whom the Zoological Society gave its Gold Medal in 1961. Reproduction of the photographs leaves something to be desired, but the text is as engrossing as ever.

AUDUBON'S WILDLIFE. A New Look at the Birds and Animals. By Edwin Way Teale. 256 pp., many illustrations from Audubon's own work, in color and black-and-white. The Viking Press, New York, 1964. \$15.00.

Mr. Teale has written an account of Audubon's life and introductions to selections of plates from the Elephant Folio and the *Quadrupeds*; the remainder of the text is from Audubon's own writings. It must have seemed like a good idea to reproduce details or portions of plates on pages 8½ by 11 inches (or 17 by 11 inches), and the printing quality is usually good, but the net impression is curiously flat.

Three for Pleasant Reading

OUT OF THE WOODS. By Esther Kellner. 228 pp., photographs. Doubleday & Co., Garden City, N. Y., 1964. \$4.95.

SAVE EVERY LAMB. By Jesse Stuart. 278 pp., sketches by Jean George. McGraw-Hill Book Co., New York, 1964. \$4.95.

THE GOOD BEASTS. By John T. Rowland. 254 pp., drawings by Joseph Cellini. Norton & Co., New York, 1964. \$4.95.

Mrs. Kellner on an Indiana farm, Jesse Stuart ("Man with a Bull-tongue Plow") in the Kentucky hills and Mr. Rowland all over the place (Connecticut, Maine, Alaska, Arizona, among others) here tell tales, reminisce, describe their wild pets and their ramblings afield, each in his own highly personal way.

New Members of the New York Zoological Society

(Between September 1 and October 31, 1964)

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Save the Date

The 69th Annual Members' Meeting of the New York Zoological Society will be held on the evening of Tuesday, January 12, 1965.

For many years the meeting has been held at the Waldorf-Astoria, but we now have so many Members that the Waldorf's Grand Ballroom will no longer hold them.

We have therefore changed the place of the Members' Meeting to the New York Hilton at Rockefeller Center, Sixth Avenue and 53rd Street.

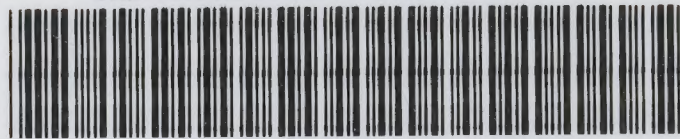
Members will, as usual, receive invitations and details of the meeting late in December.







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